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IRRIGATION MANAGER AND HIS LEGAL PROBLEMS
BY F. H. NEWELL.

HYDROELECTRIC DEVELOPMENTS ON PUBLIC LANDS IN RELATION TO IRRIGATION
B. E. C. FINNEY.

EFFICIENCY ENGINEERING FOR A POWER COMPANY
BY. E. A. WEST.

HISTORY OF ELECTRIC TRANSMISSION
BY G. O. WILSON.

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Alphabetical Index to Advertisers, Page 8 **Where to Buy It in the West, Page 9**

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IRRIGATION MANAGER AND HIS LEGAL PROBLEMS

BY F. H. NEWELL.

(A comprehensive treatment is here given of the water situation in the Western States, particular stress being laid upon the economic use of water as the determining factor in its assignment. Illustrations are given of the speculative evils which have occurred under the desert land and Carey acts and of their elimination by the reclamation act. Mr. Newell is Director of the U. S. Reclamation Service.—The Editor.)

The engineer or business man who is placed in responsible charge of an irrigation project has not only many duties connected with the purely physical side of maintaining the works and of distributing the water, but also he has dealings with hundreds of farmers. In these the most complete diplomacy and experience in human nature are none too good to insure success. Growing out of these relations are almost innumerable matters pertaining to legal requirements and the manager must continually exercise discretion in questions of mixed legal and physical fact.

Diversion Weir for a Western Irrigation System.

While it is not expected that the manager should be a lawyer, yet he must know enough of the fundamental principles of water laws, at least, to be able to state these clearly and to avoid litigation, especially over trivial matters. There is a saying in the irrigated West that "water is worse than whisky in making trouble." There is also another phrase, that of "winter friendship," implying that during the crop season every man is at warfare with his neighbor, and it is only after the crop season is over that friendly relations are established. This condition arises from the fact that the water laws in many of the states are very defective, being unsuited to the needs of the people. There are few states in the arid West in which there has been provided a well-considered and logical body of legislation. Most of the laws or customs are dependent upon court decisions, each of these resulting usually from some peculiar case. Thus they have often been apparently contradictory and inapplicable to ordinary affairs.

There are certain well established fundamentals, however, which should be recognized in every irrigated region, namely, those pertaining to the right to appropriate and take water from a stream, also the superiority of prior appropriations and the limitation of all appropriations to beneficial use.

In any general statement, it is, of course, impossible to cover the intricacies of the subject and in fact it is desirable to keep out of these and to try to obtain a broad view of some of those matters which are fundamental in the management of projects of various

kinds. In the following pages these are touched upon in a broad way, simply as indications of the questions which have been large in the minds of various managers.

Water Rights.

The extent and limitation of water rights is a subject of never-ending discussion in many irrigated communities. Through the lapse of time, the more important of these questions gradually become settled, but in minor details they continue to arise. In order to discuss them intelligently, especially with men from the humid region, it is necessary to have clearly in mind that the conditions which have prevailed in the older states, notably those pertaining to riparian rights, do not exist in the arid West.

Most of the states of the Union, excepting those within the arid region, have adopted in one form or another the principles of English common law regarding waters, the effect of which is to safeguard to the owner of land, through or along which a stream flows, the continuation of this stream undiminished in quantity and unchanged in quality. This conception, which has gradually crystallized into law in most English-speaking countries, is opposed to the conservation and use of the waters of the arid region. If put into effect, it would prevent the irrigation of any considerable amount of land, as the watering of such land must necessarily result in diminishing the flow of some stream,

In a few of the Western states, particularly California, which has an arid and a humid portion originally settled by different types of people, there is more or less conflict of law and of court decision. For example, in the northern or humid parts of the state, there has been a tendency to adhere to the doctrine of riparian rights, while in the far southern, especially in the localities settled by the Spanish, the doctrine of appropriation and use of the water was adopted by the pioneers without question. In other states, however, which are wholly within the arid region, the common practice confirmed by legislation has been for the first comer to appropriate and take for use on his land as much water as he needed; the next comer taking a portion of what was left, and so on, the first in time being first in right, and this right being limited by beneficial use on the land.

There is also a difference to be recognized in these rights. Uses of water for domestic and municipal supplies are superior to those for irrigation. In turn irrigation is superior to manufacturing and development of power, so that in case of conflict there is usually first considered the needs for the support of human and animal life, next those for food supply and the growing of plants, and third, the industries.

The irrigation manager can hardly be expected to go into these matters in detail, but he should at least have clearly in mind a few of the fundamentals of this character, and be fairly well acquainted with the state laws and decisions concerning the water rights pertaining to his particular project.

Beneficial Use.

The Reclamation Act of June 17, 1902, concisely embodies the maxim "that the right to the use of water acquired under the provisions of this act, shall be appurtenant to the land irrigated and beneficial use shall be the basis, the measure, and the limit of the right." In other words, although a man may have acquired an amount of water equal say to three acre-feet in depth on his land, yet if through any cause, such as seepage, his land does not require three acre-feet, he cannot sell or dispose of the excess, but must confine his demands to that amount of water which he can beneficially apply, any excess going back into the general stock to be utilized by those next in order of time.

At a conference in Salt Lake City, Utah, in November, 1913, a definition of beneficial use was attempted as follows:

A water user with a vested water right limited to beneficial use is entitled to that amount of water that will render him a reasonable maximum amount of good with a reasonably economic handling of the water. Since he has acquired his vested right from the laws of his state, he is entitled to protection of that right by the state; but it is his duty to the state, and the people of the state have the right to demand of him that he use every reasonable method to reduce the amount of water required to a minimum.

This demand requires the water user:

a. To make reasonable preparation of the ground surface for irrigation.

b. To use good judgment in selecting appropriate methods of applying the water to the ground.

c. To prepare reasonably efficient dikes, ditches and structures to get the water over the land in such a way as to reduce the underground losses to a minimum.

d. To irrigate the ground with such a head and at such intervals as to require a minimum use of water for proper irrigation.

e. To cultivate the irrigated ground when practicable to prevent undue losses from evaporation; in some cases possibly to govern the character of crops to be grown.

It is evident that the reasonable degree of perfection of each of these requirements will vary with the locality and with different changing conditions in each locality, so that the beneficial use of water is a variable.

Economical Use of Water.

Since the water supply available for irrigation in the Western states is adequate for only a relatively small percentage of the entire irrigable acreage, the fundamental standard of economical use must be the financial results accomplished per acre-foot of water applied rather than the yield per acre irrigated. It, therefore, becomes both necessary and desirable to impress irrigators with the fact that in general the largest net profits per acre-foot of water applied are obtained, not from using excessive quantities, but from more careful use of relatively small quantities.

In developing a more economical standard for the use of water, it should not be presumed that established rights can be limited to less water than they would carry under the accepted rule of beneficial use yet by constantly bearing in mind that the ideal ultimately necessary must be the highest net profit per unit of water applied, irrigators may gradually be induced in many instances, to obtain for themselves these results, and those undertaking the construction of new projects may be induced so to design their systems as to provide a liberal water supply during

the development period with a view to ultimate development based on economic use.

In the history of irrigation in this country, there has been evident a gradual but very definite evolution in the ideas of what constitutes proper use of water. While the use of water for irrigation was at first a relatively unimportant one, its importance now overshadows all other uses, save that of domestic supply.

In the course of this evolution, the doctrine of beneficial use has become established, but in future development this doctrine must in many cases merge into, or be supplanted by that of economic use.

Typical Irrigation Canal.

"The doctrine of beneficial use looks to individual interest; that of economic use to the general welfare of society as a whole. So far as possible, water charges, systems of distribution, and regulations should be so adjusted as to make the interest of the individual water user coincide with this public interest."

Rights of Way.

The canal system and various structures occupy certain tracts or parcels of land, the title to which has presumably been obtained before the works are completed. The character of ownership or possessions of each tract should be carefuly scrutinized by the irrigation manager to ascertain whether the right of way involves the complete ownership of the land or is simply an easement for a particular purpose.

In the case of complete ownership of the lands acquired for right of way, vigilance must be exercised to see that encroachments are not made upon these lands. There is a tendency for individuals to erect small structures, bridges, water wheels, outbuildings, and various devices upon the rght of way, and by sufferance obtain vested rights to the enjoyment of the use of the property. Sooner or later, there is necessity for changes or repairs to the canal, and these innumerable small structures become obstacles to the economic conduct of the work.

To guard against such contingencies, the character of the title to the right of way should be kept fully in mind, and the limits plainly marked with permanent stones or monuments, so that there can be little opportunity for controversy to arise regarding the exact position of the boundaries. Wherever possible, the right of way of the main canal and of its principal branches should be fenced to prevent encroachment of cattle and to establish beyond question the matter of proprietorship and control of the land.

Desert Land Act.

The legal basis for title to irrigated land in the arid region rests on a number of Federal laws, the most important of which are the Desert Land Act, the Carey Act and the Reclamation Act. In addition, large areas of land have been acquired by individuals under the terms of the homestead and other acts and by corporations under the grants made to transcontinental railroads or to states of the swamped and overflowed lands donated to the latter for purposes of reclamation.

The Desert Land Act was the first distinct recognition by Congress of the need of irrigation in the development of the West. It provided in effect that any individual might select 640 acres, afterwards cut down to 320 acres, on condition of irrigating a portion of this land. The terms are very liberally interpreted and under them large areas of lands passed into the hands of individuals and corporations without the actual reclamation and cultivation of any considerable portion. In fact, at the present time, the great bulk of the land taken up under the terms of the Desert Land Act still remains in its desert condition and is being held either for speculative purposes or forms the larger part of extensive grazing ranges of cattle and sheep companies.

It is unfortunately the case that the lands which have been granted to the states for reclamation, such as the swamp and overflow lands, and those transferred to individuals under the Desert Land Act under conditions of irrigation, have both failed very largely of that purpose, because of the lack of enforcement of the requirement of actual reclamation and the substitution therefor of so-called "constructive" reclamation in the sense that proof has been offered and accepted without actual verification of the facts.

The irrigation manager is concerned in this matter largely in knowing that certain lands with title have been obtained through reclamation under the terms of the Desert Land Act, have not necessarily been reclaimed and do not therefore always possess complete water right.

Carey Act.

Under the terms of the Carey Act of 1894, certain Western states were allowed to select upwards of a million acres, lately increased in some cases to two or three million, under condition that the state would arrange for their irrigation either directly by the use of state funds or by agreement with some corporation. The latter has been the invariable rule; the lands thus selected by the state have been the subject largely of speculation by investors more interested in the immediate profits of handling the lands than in the actual development of them.

Past and Present Pumping Methods.

The state officials are supposed to safeguard the interests of the future settlers and see to it that the works built are properly planned and completed; that there is an adequate water supply, and that the charges made for water are reasonable. As a matter of fact, the state officials charged with this duty are those who are already overloaded with other duties, who have no special knowledge nor experience in this class of work, and who through lack of continuity in office cannot make use, for any considerable time, of the experience gained.

The results which have followed the attempts made under the Carey Act illustrate the fact that a difficult and complicated business of this kind cannot properly be intrusted to ex officio trustees or directors elected for political reasons and serving for short terms. It is as impossible to achieve good results in irrigation as it would be to operate a manufacturing establishment or a railroad line, under similar conditions of control.

The consequences have been as might be expected. Many experiments have been made, large sums invested, some works completed, most of the projects in bankruptcy, and general confusion resulting. In time, after reorganization and several new starts some of the works have been put in fairly good shape. Meantime, many of the settlers have become disheartened, and the irrigation managers in charge of the works have had extreme difficulty in developing any consistent system of operation and maintenance under the changing administration or control of the work.

Legal questions which arise in this connection are, of course, of such far-reaching and difficult character that the best of legal talent is none too good. The irrigation manager must have access to competent and well informed lawyers experienced not only in the state laws regarding irrigation and Carey Act projects, but also with the Federal laws having to do with the acquisition of title under the conditions existing.

It is, of course, impossible for the irrigation manager to have more than a very general oversight in these matters but he must be kept continually informed on the details and seek for guidance in order to keep as clear as possible of the almost innumerable complications which arise where financial troubles exist and where the settlers feel that they have not been fairly treated.

Reclamation Act.

Under the terms of the Reclamation Act of June 17, 1902, the United States has invested certain funds derived from disposal of the public lands in the construction of irrigation works. The lands which at the time of the beginning of the works were in public ownership are disposed of under the terms of the Homestead Act to actual settlers and in small tracts. The government having ample funds for building the works, has constructed them with a degree of thoroughness and permanence not practicable for the corporate investor. It has thus set certain standards of construction which have been followed in part by later private builders. It has also given more attenion to the question of providing an adequate water supply. Being relieved of all questions of profit and of interest returns on the project, it has been possible to build substantial works at less price than could be done by the private investor.

The irrigation managers under the government works, utilizing the experience of older organizations, endeavor to put into effect systems of operation and maintenance based upon sound agricultural and business practices. In this respect, a standard has been set as in the case of construction of the works themselves. The legal questions which come to the cognizance of the manager are relatively simple as compared to those which may come up under the somewhat confused conditions on the larger private projects.

The Federal law itself is relatively simple and explicit as regards the building and operation of the reclamation works. The acquisition of title by settlers under the terms of the homestead act has been the subject of many decisions, so that most of the questions which arise have been determined and definite information and advice can usually be had on these points. The manuals provided by the General

Land Office and by the Reclamation Service enable the manager to secure a fairly good idea of these legal difficulties and while it is not expected that he will be immediately involved in them, he can at least obtain such broad knowledge as to be able to avoid some of the pitfalls which exist where the legal conditions are less well known and developed.

Cultivation Requirements.

The requirement of cultivation imposed by the Desert Land Act, the Carey Act and many similar laws, has been general in character, and has not always been enforced. Thus relatively little of the land, the title to which has passed from the government under conditions of cultivation, has actually been put to use in producing crops. The object of the men in obtaining lands under these laws has not always been to

A Western Electric Pumping Plant.

make a living or a profit out of the sale of products of the soil, but on the contrary to gain for themselves the unearned increment in value of the lands by subdividing and selling them in small tracts or of consolidating them in large holdings for future advance in prices.

This condition should be borne in mind in considering the general economic development of the country and in comparing statements of products from areas alleged to be reclaimed but not actually tilled with the average crop production on well cultivated lands. It illustrates also the fact that in all questions of irrigation management, there must be had for guidance reliable statistics concerning degree of cultivation and its relation to the actual amount of crop produced in order to obtain intelligent views concerning the real benefit of irrigation.

Residence Requirements.

The residence requirements, as in the case of those of cultivation, have as a rule been cut down to the very minimum, and even then have not been strictly observed. On some of the Carey Act projects the minimum term of residence has been as low as 30 days, so that it has been possible for a man living in town or in another state to take his summer vacation out on his "homestead" and acquire title by a few weeks camping on the selected spot. Under the terms of the Reclamation Act, however, actual, bona fide residence of three years is required, the theory being that the expenditure made by the government in reclaiming these lands is justified only by the acquisition of a resident citizenship. If, as in the case of the Carey Act projects, men can come out from centers of population, spend a few weeks on the ground, then acquire title, go back to the cities, there results a sparsely settled area with a population composed mainly of tenants. The state is thus deprived of the increase in resident land owning citizenship, essential to its continued prosperity.

It is of no particular benefit to the community as a whole after the work has been built to have the lands held by non-resident owners and cultivated by tenant farmers. The soil is generally impoverished, under the renting system. The local improvements such as roads, bridges and schools are neglected, the towns do not receive normal growth, and the great investment made in bringing water to the land is of relatively little use as the irrigation system is not furnishing water to more than a small proportion of the land which it can supply.

On the other hand, it is urged that the requirement of actual residence on the ground is extremely onerous and that especially in the case of orchard development, years are required before the farm is put on a producing basis. Meantime, it is asserted, the owner should be permitted to live in town or in some other state and put a part of his earnings into the improvement of the farm.

This theory is excellent if it is based on the facts, but a relatively small percentage of non-resident owners do invest their earnings effectively in their farms. Far greater damage is being done to the lands by the careless handling of the soil and water by renters so that at the end of a few years the owner seldom finds that he has a farm which is worthy of his personal attention at least to the degree of living upon it. When it is considered also that most of the young orchards never reach maturity and that, as stated by horticultural experts, probably not more than ten per cent of the orchards which are set out on irrigated land have any commercial value, the fallacy of this theory becomes apparent.

The enforcement of the legal requirement of residence on the part of the manager involves, however, many questions especially where the attempt is being made to put the newly irrigated land in fruit. Where a man and his family are actually living upon the land, as is evident to the neighbors and to the canal riders who pass the place every day or two, there can be no question involved, but, as frequently happens, the owner after setting out fruit trees spends perhaps only a few weeks in the year actually on the place, but claims that his family or a portion of it are residing there or that he has made arrangements with a relative, then there are a number of very nice questions which naturally the manager desires to avoid entering into if possible. It is also questionable whether the manager should be held responsible for the enforcement of the residence requirement and thus be compelled to be both the prosecuting attorney, judge, and jury in matters of this kind. In fact, because of his numerous other duties, this matter of residence re-

quirement, while kept clearly in mind by the manager, should be left to determination by some other authority.

Size of Farm Units.

The success of the farmer is dependent more largely upon the size of the farm which he attempts to cultivate under irrigation than upon almost any other single factor. As a rule, most men attempt to handle more land than they can properly cultivate. The man who has sufficient capital and experience to acquire and till 40 acres is apt to use his capital in making first payments on 80 acres and then diffuse his efforts over the whole tract to an extent such that the yield is far less than it would have been had the owner confined his efforts to 40 acres.

The slow development of the irrigated regions is due largely to the fact that a great proportion of the irrigators are attempting to pay for water for 80 acres out of the products of from 20 to 30 acres which are actually well tilled. The men of average means and intelligence who are making a success are those who are confining their efforts to 40 acres or even less. While there are men who can handle even larger tracts, yet these men are exceptional and their example cannot be urged as typical.

The Desert Land Act set the limit originally at 640 acres to be acquired by one man, and later cut the area to 320 acres. Later the fact became apparent that it was impossible for a man of ordinary means to properly irrigate this area or any considerable part of it. Later, the Carey Act project reduced the limit to 160 acres, and as the lawmakers began to appreciate the true conditions of irrigation, they finally in the Reclamation Act in 1902 placed a limit which "shall represent the acreage which in the opinion of the secretary may be reasonably required for the support of a family upon the lands in question." The lower limit was originally 40 acres, later reduced to 10 acres. When it was appreciated that on some of the lands, especially in the southern arid regions, where the irrigation season extended throughout the year, ten acres was seen to be all that would be needed, under good care, to support a family.

The enforcement of legal requirements regarding the size of farm units rarely comes to the attention of the manager as after the irrigated land is once subdivided and settlement has progressed there is tendency to subdivide rather than to consolidate holdings.

Electric brass-making furnaces are not in regular commercial use in the United States, although experimental melts of brass, bronze and copper have been made in several types of furnaces. Electric furnaces offer the advantage of being gas-tight (preventing the loss of zinc vapor), making possible a neutral or a reducing atmosphere, quicker melts and less labor. Their development has been hindered by the high cost of power, and also of furnace upkeep. The Bureau of Mines is conducting experiments on the design and operation of electric furnaces for brass-melting, the results of which will be published as soon as warranted by the progress of the work.

HYDROELECTRIC DEVELOPMENTS ON PUBLIC LANDS IN RELATION TO IRRIGATION.

BY E. C. FINNEY.

(Among the papers presented at the recent conference of attorneys of the Reclamation Service at Salt Lake City, W. R. King, chief counsel for the service, considers this the most important and of the most vital interest to water users in the West. The following abstract was prefaced by a brief history of irrigation.—The Editor.)

The possibilities and development of electrical energy at irrigation dams and at the drops of irrigation canals is a profitable by-product of irrigation. In 1898 Congress amended the previous act of 1891 by permitting the use of the right of way therein granted for the development of power as subsidiary to the main purpose of irrigation, and by the subsequent act of February 15, 1901, broadly authorized the use of public lands and reservations for all structures and fixtures necessary or incidental to the generation, transmission and utilization of hydroelectric power. This law may be said to have begun the era of development of the water-power possibilities of public domain and to provide necessary legislative permission to those who, reversing the theretofore generally accepted laws of nature, proposed to make water run uphill. The best of the low-lying lands had been covered by gravity irrigation systems, and the settlers looking longingly toward the mesas and mountain slopes not capable of being reached with gravity water, yet possessed of immensely rich soil and adapted by nature to the production of the finest quality of fruits and of practically every crop suited to the locality and climate.

Secretary Franklin K. Lane, at the outset of his administration of the Department of the Interior, turned his attention to the water-power situation in so far as it relates to public lands and reservations. At his instance a measure was introduced and has been favorably reported by the committee on public lands, house of representatives, and it is hoped will receive favorable action during the present session of congress.

The bill, in the event that charges are collected in any project, devotes the entire proceeds to the reclamation of arid lands in the Western States, and further provides that upon return to the reclamation fund of the moneys so expended 50 per cent of the amount so returned shall be paid to the state within which the hydroelectric power occurs, for the support of educational institutions or the construction of public improvements, or both. The bill seeks to protect the investor, encourage investment, secure early development of the water-power resources under conditions favorable to the public, but retains fee or reversion in the United States for such use or disposition as may appear proper and expedient to the people and to congress at the expiration of leasehold periods.

Water power development and irrigation of arid lands in practically all of our Western States are inseparable, or, at least, closely related. Congress thus recognized the importance of utilizing the electrical energy developed in connection with gravity projects for the pumping of water to to high levels.

The reclamation law of June 17, 1902, said nothing about the development of hydroelectric power, but

four years later congress recognized the fact that power should be developed and might be necessary for the irrigation of lands under such projects, and provided that in such cases surplus power or power privileges might be leased for periods not exceeding ten years, giving preference to municipal purposes. In many of our existing reclamation projects hydroelectric power development at the dams or drops in canals are used by the United States in the pumping of water to lands above the gravity canals, and in other projects power or power sites have been leased to private individuals or corporations engaged in similar irrigation of high lands.

Cheap electrical power will be of vital importance in another respect in those reclamation projects where drainage becomes necessary and where it is not feasible to reach and drain all of the water-logged lands by gravity, pipes or ditches. For with cheap electric current it will be entirely practicable to drain and keep drained these low-laying areas which would otherwise be rendered worthless for agriculture.

A practical illustation of the utilization of water and power resources is given in a recent paper by Frank G. Baum of San Francisco, where a power company in California stores flood waters in a high dam at an elevation of over 5000 ft. above sea level. After being released from the dam the water passes through a series of six power houses, utilizing a total drop of 4140 ft. for power purposes, generating more than 100,000 constant horsepower, the water being discharged from the last power house into irrigation canals which will accomplish the irrigation of more than 60,000 acres of arid lands.

One of the advantages of pumping by hydroelectric power is that the energy may be furnished by a large distributing plant, which supplies the whole region, and which will thus permit of dividing the work of irrigation among a number of successive stations, irrigating at the outset only those that are likely to pay, keeping pace with the natural growth of the demand for irrigation instead of tying up capital in a complete plant for a long period before it can become productive.

The irrigator whose lands are within the scope of an electric power development derives other advantages from the power so generated than the mere lifting of the water to his lands. The same wires which carry light for his house operate his threshing machine, sawmill, corn sheller and churn, and eradicate much of the heavy and unpleasant labor formerly attendant upon farming. To the irrigator it means a steady and sufficient flow of water whenever desired and wherever pipes are carried uphill or downhill. There is no waiting for a "turn" at the water in a lateral which serves a half-dozen farmers. There are no annoyances from clogged or weedy ditches or broken canals or laterals; nor at the end of the irrigation season is it necessary to turn out to clean and put into condition laterals and canals in anticipation of the new season. Through clean open pipes, which will not clog with vegetation or weeds, which do not break or get tramped out of condition by livestock, a continuous flow of water reaches the exact spot in the farmer's field where it will do the most good, and continues to flow until the requisite irrigation has been accomplished.

The saving of water is an important and material result of the use of electric pumping and of the pipes through which the water is forced, for it eliminates loss by seepage and evaporation. The experience of many irrigators had already fully demonstrated the value of these, to the West, most important uses of hydroelectric energy. But other developments and uses of this power upon the lands are of indirect interest to irrigation and irrigators.

Lack of markets or inadequate transportation facilities for his crops are enormous hindrances to the farmer of the West. This means not only loss and delay, but in some instances the total failure of his enterprise. The presence of an extensive development of hydroelectric energy in the irrigator's neighborhood may mean factories, manufactories, electrically-operated railway lines, and a score of industries and enterprises which will attract to the vicinity a population which will require and take, at profitable prices, the produce of the land.

It is therefore of vital importance not only to the people at large, but to the farmer upon the irrigated lands of the west, that these resources be rapidly and fully developed, under such laws and restrictions, however, as will preclude this beneficient public utility from becoming a monopoly for the oppression of the people instead of their servant and aid to prosperity.

Far-seeing statesmen propose to retain in the United States the ownership of these valuable power sites for the public lands and reservations, and to procure development through long time and definite leases, thus retaining such control over the future as will enable the American Congress of that day and generation to make new and proper legislation fitting those times and their needs, and thus insuring the greatest and most enduring good to the people generally, but particularly to those of us whose homes are in the West, and whose interests in water and its possibilities are direct and vital. With the full and wise development of the irrigation and power possibilities of the West, her opportunities for increased prosperity and well being are boundless, and will far out-distance the most vivid word picture of our Western boomers.

Denatured electricity, an interesting method of preventing the improper use of electric current, has been devised by an Italian engineer. The practice of making especially low rates for current to be used in electric power, heating and cooking devices is becoming more and more general, but with the ordinary constant potential current it is difficult to detect the use of lighting devices on circuits intended only for power and heating purposes. This engineer advocates the use of special circuits on which the current is subject to extreme fluctuation of voltage at rapidly recurring intervals, which would make it practically impossible to use lamps, because of the flicker in the lights. As the current is not entirely interrupted and the normal voltage is almost immediately restored the proper operation of power or heating apparatus is not interfered with and the rightful use of the circuits for their respective purposes is assured. (Society for Electrical Development.)

EFFICIENT POWER PLANT MANAGEMENT

EFFICIENCY ENGINEERING FOR A POWER COMPANY.

BY E. A. WEST.

(The author, who is efficiency engineer for the Portland Railway, Light & Power Company, shows the application of modern efficiency methods to power plant operation, laying particular stress on the difficulties to be met.—The Editor.)

Old Foreman "Kant Be Dunn" would hold his hands up in "holy horror" if he were told that hereafter he would only be required to watch his workmen and help them get their work out in the time allowed. He would pass away entirely if told the part of a job which was to be done first, the order to be followed, the time it should be started and the length of time required to do it in. In some cases the man or machine that would do it is named and all this is looked after by a "white collared" crew located in the works office or at headquarters.

The superintendent and foreman of today, however, are not at all surprised at the new "stunts" that emanate from the office; in fact, they, many times, anticipate the office by making suggestions that will bring about better operating or construction efficiencies.

Efficiency—probably next to the term "narrow-minded," (which is always used to classify the person who does not agree with you), is the most abused word in modern vocabulary. Ever since Brandeis opened up on the transportation companies' representatives with his array of efficiency experts in the famous rate case before the Interstate Commerce Commission, a few years ago, every magazine had its fling at scientific management—"motion studies," "cost keeping" have become as firmly fixed in engineering parlance as stresses, strains, volts, kilowatts, etc., and from every quarter "hungry looking" individuals, with the "gift of gab" are haunting the offices of large industrial concerns, ready to put the particular concern so far ahead of itself that the strange thing about it all is that they ever got as far as they did in a business way—the firm I mean.

The writer recently interviewed a young man of this type, who was applying for a position. In his conversation he used in a most promiscuous manner all of the familiar terms and phrases popularly associated with scientific management. Although he had only worked in four places, (about six months in each place) he had never risen above the one hundred dollar mark, his education was extremely limited, and he had positively no engineering nor shop training. Yet he offered to put in a complete planning and cost keeping system in a large street railway shop, employing over two hundred men.

The light and power companies offer a splendid field for the efficiency man. First: Because this phase of electrical work has largely been developed by men with engineering training, and is, therefore, a scientific product. Second: Because in this day of conservation and regulation every energy is bent to reduce the manufacturing cost of electrical energy. In this connection both fixed and operating costs require careful study. Third: There has not been as much attention paid efficiency engineering by light and power companies as by other manufacturing corporations whose output is measured in terms of pieces rather than energy.

Of course, for a long time, considerable study was made of fuel efficiency, and there is no doubt but that the wonderful savings effected in the boiler rooms of generating plants had much to do with the furthering of scientific studies in other phases of manufacture. For a long time engine room men studied indicator cards and valve design, with some resulting economies. One day some one thought of the boiler room and the coal pile—a heretofore neglected opportunity. Here the studies were not so simple or pleasant as in the engine room with its shiny brass work and tiled floors. The investigator had to have a first hand knowledge of boiler room practice, mechanical design, operating requirements, water, fuel and gas chemistry, with an inclination to dig in and work himself. It is needless to go on. The results of these investigations are too well known for further comment. The underlying thought back or under all this is, that we go along for years pecking at the 5 or 10 per cent items of expense and leave the 90 and 95 per cent items to shift for themselves because of the tremendous or apparently tremendous amount of work that will be involved in straightening them out.

Everything that is said in a general way regarding this whole subject, will only be, and can only be, a repetition of what has already been said, and yet it is extremely difficult to try and outline in a single article, the details of any one scheme. In the writer's experience as an efficiency engineer for one of the largest utility companies on the Pacific Coast, it has been his pleasure to see in the last few years a great many changes made in operating and construction methods that have materially reduced costs.

The writer wants it distinctly understood that he takes absolutely no credit for any part of this work. His position has been rather that of an investigator and watcher. The actual work of developing what efficiency systems have been carried out, has been done by the superintendents, foremen and workmen in the various departments.

The old bugbear "our business is different," has of course cropped up many times in making these studies, and the men who have made these statements are not altogether to blame. Their every day life is taken up with many problems, they have all of their working moments and a great many of the hours that they are supposed to be resting and playing, taken up with the perplexities of getting work done. The very speed at which it is necessary for them to work and the fact that their noses are right down to the grindstone, has in many cases been the reason for their not

putting into effect ideas that they have had pigeonholed away in a corner of their minds, as things to be accomplished. They were unable to carry out their ideas for lack of proper time in which to make the necessary studies and developments. The efficiency engineer, and his force of cost accountants, comes in handy at this point in the every day work of the busy foreman and superintendent, because he is more or less of a free lance and can turn his energies and those of his cost accountants toward solving and working out the problems of the foremen and superintendents.

It might appear from the foregoing that the efficiency man's path is strewn with roses, and that all he has to do is to take the suggestions of the men on the firing line and formulate them, much as the writer does who takes ideas submitted to him and builds a story. This is not the case however. Many times the suggestions that come involve several individuals or departments and it is the getting together of these departments on a single footing that makes the difficult part of the efficiency man's work. I think that no where else in the world does the word and meaning of "inertia" apply so well as it does to the everyday work of the efficiency man trying to bring something around.

When he calls on the "other fellow" to outline some policy, or change or to feel him out, he is usually met with a smile and banished with a frown. The smile because the other fellow does not know just what is coming, the frown because the other fellow usually has a bad taste in his mouth when the efficiency man leaves and the banishment is usually preceded by a whine something as follows: "It seems to me Mr. ——— that there are plenty of other things that can be done in the organization, other changes that are more imperative without your getting into this matter. If you confined your efforts, etc., etc."

Sometimes, too, it is necessary for the efficiency man to recommend changes which will not mean a saving in dollars and cents but will necessitate an outlay of money that often times looks, on the face of it, like a needless expenditure. Recently a matter came up which called for either purchasing and installing a particular class of machine or having certain work done outside at an additional cost to the company of several thousand dollars a year. It was proven that out of 574 articles used by the company, some 318 could be made by installing this certain piece of apparatus. Much pressure was brought to bear in favor of the installation of this apparatus by some department heads, and the apparent saving in sight was not a myth, but could be made an actual reality. However, after going into the matter with every one concerned the efficiency man had to recommend that the machine idea be abandoned for the reason that, although it would be possible to save from $3000 to $4000 a year, the establishment of a machine by the company might mean a loss of $12,000 or $15,000 in revenue due to the loss of consumers running plants that turned out this kind of work. In fact the labor element might become involved in the matter also, as most all of the larger establishments of this kind are strongly unionized. His decision was also influenced by the fact that a competitor in the field in talking to prospective customers that did this kind of work, could use as an argument in favor of their company, the fact that they had all of their work of this class done by the outside firms.

All of the phases surrounding matters of this kind must be looked into by the efficiency engineer very thoroughly before making a recommendation. Many times his viewpoint is altered after he has looked at the commercial side of the matter. His best work comes in when he gets all hands together on a proposition of this kind and explains the reasons for or against it. In large corporations, where so many different departments exist, only one phase of a supposed change may present itself and a department may go ahead and institute a change which will play havoc with the work of another part of the organization.

Co-operation and co-ordination, two of the stock phrases of the efficiency expert, are likewise his monitors in all he undertakes.

"Cost keeping" and "cost analysis" are two of the necessary tools of the efficiency man, but cost keeping alone, even though accurately conducted, will not do the work unless the reasons and why of every item shown are gone into. As an example—at one time the hole digging crew of the line department used the trolley cars in going to and from their work. The transportation department objected to the use of front or rear platforms of the trolley cars by the hole diggers on account of the shovels and digging bars, that had to be carried, soiling the clothes of the regular passengers. It was decided that a light automobile truck should be pressed into service to take care of the hole digging crew. The cost per hole, under the old arrangement, for travelling time and street car fare, averaged about 26 cents; using a light truck the cost jumped up to pretty nearly one dollar, due to the fact that the automobile expense and the driver's expense had to be added to the lost time of the hole digger.

At a conference in the general line foreman's office one day, when the matter of unit costs were being investigated and discussed, the suggestion was made by the line foreman that a lighter automobile could do the work just as satisfactorily and instead of having a driver, the hole digging crews' foreman could handle the machine himself and take the men to the various locations and pick them up. The suggestion was acted upon with the result that the cost of digging holes, transportation and lost time, dropped down to 16 cents which, it is seen, is considerably less than the original cost when trolley cars were used, and considerably less than when the light truck was used. Inasmuch as there were some five hundred holes dug per month, the difference in the two costs amounts to quite a saving.

I use this to illustrate the fact that the costs were accurately kept when the hole diggers were using the trolley cars and were accurately kept when the hole diggers were using the automobile and that any rise or fall in the average cost per month, or per week, or per job, was gone into to find out why it differed from the standard costs, but, that even though these costs were checked and used as a check on the crew, there was still a better method lying around the corner that would reduce costs further.

This is analogous to the adoption or installation of a new kind of a machine tool in a factory. The tool replaced may have done its most efficient work but cost three times more per unit than the new tool.

In light and power companies, the line and underground departments, arc lamp department, meter department, electrical construction and maintenance departments can all be lined up and put on an efficiency basis by first bringing the men, in charge of these departments, to a realization of what scientific management means. Second by having them bring their individual workmen into the proper attitude and third by impressing upon each and all that the company is not entering into any slave driving practice, but that the object point in view is to increase rather than decrease wages and fourth that every change made by the men that produces a saving, should be taken into consideration and the men receive some other reward than a mere "thank you." Increased efficiency should always mean increased pay. Any saving made by the men for the company should be split up on a basis that will allow the men a substantial return for the efforts they have put out to bring about efficiency.

Pumping California oil is accomplished by several kinds of power whose relative importance has been determined by the U. S. Bureau of Mines as shown in the following table:

Field.	Steam. Beams.	Steam. Jacks.	Electricity. Beams.	Electricity. Jacks.	Gas Engines. Beams.	Gas Engines. Jacks.	Compressed air.	Flowing.	Total wells.
Coalinga	335	13	66	...	487	10	...	...	911
Lost Hills	45	...	5	...	21	...	...	31	102
McKittrick a	150	19	14	...	90	8	30	...	311
Midway	217	...	350	...	200	...	50	100	917
Sunset	181	10	...	...	40	...	25	b 50	306
Kern River	790	255	96	300	12	154	92	...	1699
Santa Maria	94	9	...	...	130	...	...	b 7	240
Summerland	...	122	...	...	...	...	...	...	122
Santa Paula	5	...	...	...	30	295	...	...	330
Newhall	...	...	...	...	7	69	...	...	76
Salt Lake	60	...	25	...	155	...	c 50	...	290
Los Angeles	...	27	...	10	...	383	...	...	420
Whittier-Coyote	66	32	3	...	...	29	...	12	142
Puente	4	20	...	...	...	30	...	...	54
Fullerton	148	29	...	...	45	64	...	17	303
Total	2095	536	559	310	1217	1042	247	217	6223

a Includes Belridge.

b Includes wells in which agitators are used.

c Compressed air used in steam engines in place of steam.

The waste of water in irrigation varies from 10 to 90 per cent, according to conditions. In storage reservoirs 10 to 60 per cent evaporates, in main canals 17 to 45 per cent is lost by seepage and evaporation and in distribution canals from 30 to 50 per cent. Finally from 10 to 15 per cent is wasted by surface run off. Most of this waste can be eliminated by pipe line or covered and lined ditch.

The U. S. Government exhibit at the Panama-International Exposition in San Francisco has been divided into sixteen grand divisions or sections, representing all of the executive departments, except one, and seven independent offices and commissions. The departments to be represented by exhibits are State, Treasury, War, Postoffice, Navy, Interior, Agriculture, Commerce and Labor, and the other divisions comprise the Civil Service Commission, the Isthmian Canal Commission, the Library of Congress, the Smithsonian Institution, the Commission of Fine Arts, the Government Printing Office and the American National Red Cross.

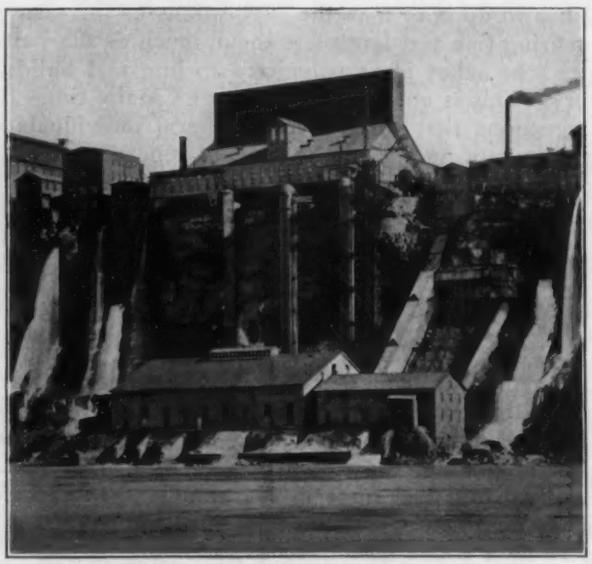
HISTORY OF ELECTRIC TRANSMISSION.

BY G. O. WILSON.

[Continued.]

(In this instalment Mr. Wilson relates in an interesting manner the pioneer developments at Niagara Falls, comparing their importance with the early transmission projects of the West and South.—The Editor.)

While all of these plants were important as beginnings of the development of power transmission in this country, by far the greatest work of this period was done at Niagara Falls, in the beginning of the development of the mighty power available there. For many years engineers had realized the enormous opportunities for development, and as early as 1861 a canal was built through the town of Niagara Falls for the purpose of developing hydraulic power at the edge of the gorge, below the falls. In 1872 the rights to the power from this canal were purchased by Messrs. Jacob Schollkopf & Son, who founded the Niagara Falls Hydraulic Power & Manufacturing Company. At the start this was simply the operation, under one management, of separate water wheels at the plant of each consumer; but the owners of the enterprise soon saw the advantage to be derived from a system of central production and distribution of power, and in 1881 they had erected what might be called a central station, with distribution of the power generated by means of belts, shafts, and ropes to a number of factories along the edge of the cliff. The wheels in this power plant were only capable of utilizing 50 ft. of the available 210 ft. fall; and when, a few years later, an attempt to utilize 75 ft. was made, a great deal of trouble was experienced. By the end of the year 1896, however, when a new power house was completed by this firm, with 4500 kw. of electrical equipment, the full 210 feet of head was utilized.



Plant of Niagara Falls Hydraulic & Mfg. Co.

While this company was thus developing, another great Niagara concern was getting under way. In 1886 the Niagara Falls Power Company was incorporated, for the purpose of deriving a vast amount of power from the waters of Niagara. In 1889 a subsidiary company, the Cataract Construction Company,

was formed for the purpose of doing the actual construction of the hydraulic and power equipment at Niagara. The plan of this company was to draw water from the river at a point above the falls through a canal 500 ft. wide and 1500 ft. long, constructed through the town of Niagara Falls. At a depth of about 250 ft. below the surface a tunnel 6700 ft. long was to be bored, with its portal at the base of the gorge below the falls. Hydraulic turbines were to be placed in pits at about the level of this tunnel, the water from the canal being carried down these pits in steel penstocks, passing through the turbines, and discharging into the tunnel, which acted as a great tail race.

Professor George Forbes of London was engaged as the consulting electrical engineer, and Professor W. C. Unwin as hydraulic engineer. In commenting editorially on the fact that the chief engineers for this and other large power projects in this country were most all from Europe, the Electrical World accounted for it by saying that the rapid development of lighting and railway work here had prevented us from keeping pace with Europe in power development. And it is a fact that practically all the "Power Notes" in that journal from its initial volume in 1883 until 1889 were in regard to railway developments or lighting.

At the outset of the Niagara project, all manner of wild schemes were brought forward. It was suggested that it would be cheaper to place the whole plant in a cavern in the rocks immediately back of the falls, drawing the water either vertically down from the river above, or through pipes stuck up so as to dip into the under edge of the great mass of water pouring over the falls, so as not to deface them in any way. The engineer in charge of the Frankfort line thought that transmission of the power from Niagara to New York, and even 500 miles to Chicago, would be perfectly feasible at 50,000 volts and an efficiency of 60 per cent. Many engineers urged that it would be more economical to develop only hydraulic power with the water of the canal and tunnel; the water to be sold to individual consumers, with the privilege of constructing individual pits at their plants, and placing therein turbines to drive their machinery through long shafts to the surface, the water being permitted to discharge into the Cataract Company's tunnel.

This last plan was adopted by the owners of the canal as a part of their scheme of development, and indeed the first power developed was 3300 hydraulic horsepower sold to the Niagara Falls Paper Company, who started their turbine in 1894. But Prof. Forbes, who had visited all the principal electrical power plants in the world, recognized the value of a great central station for the generation of electrical power, and accordingly set about to design the greatest one in the world. The generators, of which three were to be installed at first, were of 5000 h.p. capacity each. Prof. Forbes designed these generators to be of the revolving field, or "umbrella," type, two-phase. He strongly advocated a frequency of only 16 2/3 cycles per second, but yielded to the storm of criticism this evoked from engineers all over the world, and raised this to 25 cycles. Even this was decried as being too low, on account of the size of transformers which it would necessitate; but Professor Forbes showed that this increased transformer cost per h.p. was mythical, on account of the very large transformers which would be necessary anyway to handle the great power developed.

To understand how thoroughly modern and progressive Prof. Forbes' design for these great generators was, it is only necessary to remember that when seven similar machines were installed in 1898 and 1899, they were of substantially the same design, in spite of the wonderful progress in the electrical art in the intervening years, and to remember, also that those ten generators are still in successful, continuous operation today. In view of this fact, it is a sharp contrast to know that he was afraid to trust his transmission system to overhead wires, but insisted on a costly tunnel for the local distribution, and wanted to build it all the way to Buffalo.

It might be noted here that at the very outset of the scheme, the promotors called for the opinions of two of the most prominent engineers in the world, Lord Kelvin in England and Prof. Rowland of Johns Hopkins in America, as to the best electrical system to adopt, and both reported in favor of direct current. Rowland was subsequently converted to Forbes' scheme of low-frequency alternating current; but Lord Kelvin persisted in his predictions of ultimate ruin up to the very instant of successfully starting the plant.

In 1891 bids for the power house, with its great wheel-pits 240 ft. deep, and the large generators, were called for. In 1892 Forbes and Unwin came to America to consult with the directors of the company. After this conference it was announced that in addition to the American plant at the town of Niagara Falls, a similar large plant was soon to be started on the Canadian side. It was stated that this project would be cheaper for the company, as 100,000 h.p. could be developed with a tunnel only 800 ft. long; and that the power developed at this Canadian plant would be the power transmitted to Buffalo, for three reasons: (1) because the Canadian plant would be nearer to Buffalo than the one at the town of Niagara Falls by several miles; (2) because the power generated at Niagara Falls would be all used by the local manufacturing plants building there; (3) 100,000 h.p. could not be consumed in that part of Canada for many years. This scheme was never carried out by the original promotors, however, for in 1901 the only plant on the Canadian side of the river was a small, obsolete plant of only a little over 1000 h.p. capacity.

In the latter part of 1892 the canal in Niagara Falls was completed, and early in 1893 the tunnel was also finished. About the same time the contract for the first of the three great generators was let to the Westinghouse Electric and Manufacturing Company. Contracts for the other two soon followed, and on April 5, 1895, the first machine was successfully started and a mechanical test made. On July 1st, the first current was sent over the wires to the Pittsburg Reduction Works, to test the line, and by the first of September all of the power available at the power house, i.e. 10,000 h.p. was being delivered to the Pittsburg Reduction Company, the Carborundum Company and the Buffalo and Niagara Railway.

With this ready market for its power close at hand, the company could afford to be independent in its dealings with the city of Buffalo in regard to securing a power franchise. The city council attempted to place onerous conditions on the entry of the company's lines into the city; but after more than a year of bickering, that body finally consented to a contract under which the company felt that it would be commercially practicable to operate.

The twenty-six mile line to carry the power to Buffalo was designed for an ultimate capacity of 10,000 h.p. to be carried on a double three-phase line, one set of three wires being mounted in a horizontal plane on each side of the pole, and complete transposition being effected every five poles. The poles used were from 35 to 65 ft. high, and at the start only one of the three-phase circuits was installed, the other half of the cross-arm being left unoccupied.

This was hailed as the greatest transmission project in the world; but as a matter of fact the West already boasted several projects equally important, from the point of view of voltage used, power transmitted, or distance of transmission.

The original San Antonio plant transmitted almost as much power over a greater distance. In 1895 the Portland Light & Power Company transmitted 1350 kw. fourteen miles to Portland at 5500 volts, and in the same year the Folsom-Sacramento power line was put into operation, transmitting 3000 kw. 22 miles at 11,000 volts. The 750 kw., three-phase generators in this plant were the largest three-phasers built at that time, although the 5000 h.p. two-phasers had been installed at Niagara.

Still another plant started in 1895 was in Nevada county, California, where a plant was built to supply power for mines, 1000 h.p. being transmitted a maximum distance of eight miles. This was one of the few California projects in which two-phase generation and transmission was employed.

Early in 1896, before the contract for the Buffalo line was let, a hydraulic development at Hidalgo, Mexico, was transmitting 1200 kw. a distance of 23 miles at 10,000 volts; and the San Joaquin Electric Company of Fresno was transmitting 1020 kw. a distance of 34½ miles, the maximum length of commercial transmission in the world at that time, the voltage being 11,000. Still other projects larger than the Niagara-Buffalo transmission at the time it was opened, from the point of view of amount of power transmitted, were the Big Cottonwood plant, transmitting 1800 kw. at 10,000 volts 14 miles to Salt Lake City, and a plant in Guatemala, where 1300 h.p. was transmitted 22.5 miles at 10,000 volts.

Nor were these large early developments confined wholly to the West. The large water powers in the South were early put to work driving the cotton mills, and in 1894, 3000 h.p. was being transmitted 2⅝ miles at 3500 volts, from a river power plant to a cotton mill near Pelzer, S. C. In 1896 a smaller plant was put in at Anderson, S. C., 150 kw. being transmitted six miles at 5500 volts; and in the latter part of the same year 5000 more h.p. was developed at Pelzer and transmitted 3½ miles.

[To be continued.]

LETTER TO THE EDITOR.

Municipal Lighting Burden.

To the Editor:

The superintendent of the municipal lighting plant of Seattle has repeatedly stated to the public in print that the municipal lighting plant is not a burden to the taxpayers, but, on the contrary, is paying all of its operating and fixed charges in cash, besides accumulating a surplus and depreciation reserve fund.

A careful study of the annual report of the Lighting Department issued for the years 1912-13 and abstracted in your issue of July 11, will disprove this statement. It will be necessary to go somewhat thoroughly into the published figures in order to arrive at the truth. In the report will be found data showing the number and kind of lamps used for street lighting at the end of the year 1913. As the result of a study of this data, the following table has been prepared:

No.	Kind.	No. Lamps.	Watts.	Kw. Demand (At lamp).	Annual consumption based on 4000 hrs.*
1179	5-lamp clusters	5895			
337	3-lamp clusters	1011			
137	1-lamp posts	137			
	Total cluster	7043	50	352.15	1,408,600
6365	Series incandescent	6365	50	318.25	1,273,000
306	Series incandescent	306	350	107.10	428,400
767	6.6 Amp. arcs	767	430	329.81	1,319,240
70	Viaduct lamps	70	50	3.50	14,000
	Total series lamps			758.66	3,034,640
	Total series and clusters			1110.81	4,443,240

* According to the report of the superintendent.

The efficiencies of the street lighting system are not given in the 1912-13 report, but are given in the 1911 report. It is assumed that these have not changed and are as follows: For the series system, 86.3 per cent, and for the cluster light system, 79.1 per cent from lamps to substation. With these efficiencies, the demand of 1110.81 kw. of the street lighting system at the lamps becomes 1324.3 at the substation, and the kw.-hr. consumed at the lamps 4,443,240 becomes 5,206,969 kw.-hr, at the substation.

Furthermore, the maximum demand of the entire street lighting and commercial systems at the substation is given as 9625 kw., of which 1324.31 kw. is the street lighting demand, and this is approximately 13.8 per cent of the delivered power for street lighting and 86.2 per cent for commercial lighting and power, including lighting and power for municipal buildings. The report also states that the total power of the system delivered at the point of consumption was 26,306,861 kw.-hr., of which 4,799,670 kw.-hr. were delivered to the street lights. The rate charged to the taxpayers for this street lighting is 4.5 cents per kw.-hr. and at this rate 4,799,670 kw.-hr. would produce $215,985.15 per annum. The financial report, however, shows that the street lighting revenue for 1913 was $211,013.65—the discrepancy being due no doubt to the fact that some of the five-light cluster posts have been burning only three lamps instead of five, which was done in order to keep down the excessive cost of street lighting. The total revenue of the department for 1913 from the sale of current is given as $904,763.07, of which $211,013.65, or 23.3 per cent, was collected from the taxpayers through the charges for street lighting and $693,749.42, or 76.7 per cent, is the revenue that was obtained from the sale of current to commercial and other consumers, including lighting and power for use

in public buildings of the city and for other municipal purposes, which of course was also paid by the taxpayers.

The following data based on the report will show at a glance how the taxpayer is being burdened in order to swell the revenues of the department.

The financial statement shows that a total of $245,089.99, or 27 per cent of the gross revenue of the department from the sale of current, came from the taxpayers for municipal services.

	Commercial Consumers.	Taxpayers.	Total.
Maximum load at substations...			9625 kw.
Max. load delivered at substation for commercial use.....	8300.7 kw.*		
Max. load delivered at substation for street lighting.....		1324.3 kw.	
Per cent of max. load delivered at substation for commercial use	86.2%*		
Per cent of max. load delivered at substation for street lighting..		13.8%	
Total revenue from sale of current			904,763.07
Revenue from commercial light and power.....693,749.42**			
Revenue from street lighting....		211,013.65	
Per cent revenue from commercial light and power.....	76.7%**		
Per cent revenue from street lighting.....		23.3%	
Rev. per kw.-yr. from commercial lighting.....	$62.82		
Rev. per kw.-yr. from street lighting.....		$189.99	
Rate per kw.-hr. at consumers' premises, commercial light and power.....	2.53c		
Rate per kw.-hr. at lamps, street lighting.....		4.39c	

* Includes power used for municipal lighting and power purposes other than street lighting.

** Includes revenue from municipal lighting and power other than street lighting.

The above figures show that 13.8 per cent of the utilized capacity of the plant is used for street lighting and returns 23.3 per cent of the total revenue derived from the sale of current, while 86.2 per cent of the capacity used for commercial, municipal building lighting and power, produces 76.7 per cent of the total revenue.

Again, the average rate per kw.-year paid by the taxpayers for street lighting is $189.99, while private consumers get their lighting service at an average rate of $62.82 per kw.-year.

Referring to the report, it is stated that 8,289,327 kw.-hr. were furnished for business lighting, and on the same page the estimated maximum load for business lighting is stated to be 3340 kw., and later the revenue from this service is given as $209,969.93. The report states that the average return per kw.-hr. for this service was 2.757 cents, but the application of a simple division will show that the current figures should be 2.53 cents plus per kw.-hr.

According to the report, the street lighting system consumed at the lamps 4,799,670 kw.-hr., which was at the rate of 4.39 cents per kw.-hr. Why the full allowance of 4.5 cents fixed by ordinance was not collected from the taxpayers is not explained. Against this rate of 4.39 cents per kw.-hr. with a load factor of 4000 hours per annum, the private consumers using light in business houses paid only 2.53 cents per kw.-hr.

The estimated maximum demand load of power customers is given as 3410 kw. and the consumption as 7,396,534 kw.-hr., while elsewhere the revenue is given as $98,904.96. The average revenue per kw.-hr. is stated to be 1.549 cents. There apparently is an error here, as the division makes the average rate 1.34 cents plus per kw.-hr., while the average rate per kw.-year is $29.00.

The superintendent says "It (meaning the municipal plant) is in no sense a tax burden."

On October 9, 1912, the Puget Sound Traction, Light and Power Company submitted a bid to the city of Seattle to light the streets of Seattle, in response to a request from Councilman E. L. Blaine. The company offered to furnish the current at its tariff rate of 2.75 cents per kw.-hr., maintain the street lighting system at its own expense and turn the same over to the city in first-class condition at the expiration of the contract, paying 25 cents per pin rental on city poles, and in addition pay the city $40,000 per annum as rental for the use of the street lighting system owned by the municipality, which was in excess of 10 per cent of the cost of the street lighting system, exclusive of the street lighting system furnished by the property-owners. Taking the efficiencies given by the superintendent in his report for 1911, the Puget Sound Traction, Light and Power Company would have been required on its bid to deliver at the city substation last year 5,206,969 kw.-hr., and at the rate offered by that company (2¾ cents per kw.-hr.) the street lighting service would have cost the taxpayers $143,192.99, with $40,000 returned to the city for rentals of the street lighting system, as against $211,013.65 actually paid by the taxpayers.

If a large surplus was earned in 1913, as alleged in the report, why were the taxpayers burdened with this extra charge? Why are the taxpayers required to pay $189.99 per kw.-year for street lighting, while the business houses get a rate of $62.82 per kw.-year? Why are the taxpayers charged 4.5 cents per kw.-hr. for street lighting when business houses are getting a similar service at an average rate of 2.53 cents per kw.-hr.? It is a well-known fact that business houses with the same load factor as the street lighting system are getting their service for 1.5 cents to 2 cents per kw.-hr.

When the rates charged the taxpayers for light and power for supplying the municipal buildings and shops are examined, it is found that the lighting department takes advantage of the taxpayers probably because there is no competition. All of the public buildings pay a rate of 3 cents per kw.-hr. for lighting and 2.5 cents for power, as against 1.5 cents to 2 cents for power charged by the city to private consumers. For this service the department collected from the taxpayers in 1913 the sum of $34,076.34, which would have cost the taxpayers approximately $20,000 if the service had been furnished at the same rate that similar service is furnished to private consumers.

If it is true that the municipal lighting plant in 1913 earned a surplus of $242,257.68, as alleged by the lighting department, why were the taxpayers mulcted out of $87,820.66? Is not the public being misinformed by the frequent statements of the department that "the taxpayer is in no way burdened to support the municipal plant"? If the department up to and including the year 1913 has earned a surplus of $810,100.21, has this surplus not largely come out of the taxpayers through the excessive charges made by the department for public lighting and power service?

The assessed valuation of the city of Seattle is $215,362,151, and this excess charge of $87,820.60 increased the rate 41 mills.

It is quite evident that an increased burden has been placed on the taxpayers through the increase in the rates for street lighting as shown by the rate charged in 1905, the last year the service was supplied by a private company. At that time the city paid $66 per annum flat for a 6.6 ampere arc lamp. These lamps were purchased by the city when it took over the private company's street lighting system, and are still in use. A little calculation, using the superintendent's data, shows that the taxpayers are now being charged $77.40 per lamp per annum for this same service when the current is measured at the lamp and $89.33 per lamp-year if it is measured in the substation; while the series incandescent and cluster lights are being furnished at a correspondingly greater cost per kw.-hr. than in 1905 and at rates far in excess of the published schedule of the private company.

The report states that "the lighting and power plant has an investment of more than $5,000,000." Property in Seattle is assessed on the basis of 45 per cent of its value, so that the lighting plant for taxation purposes would show a value of $2,250,000, and at 43.87 mills would yield in taxes $109,675, and which of course is lost to the taxpayers. Does this loss in no sense affect the taxpayer?

Furthermore, the City Council of Seattle has adopted a resolution to redeem $50,000 of bonds of an issue of $400,000 sold in 1903, to construct the municipal lighting plant. These bonds were sold to the state of Washington and draw 3¼ per cent interest, maturing in 1923. The bonds provide that it is optional with the state to permit their redemption before maturity. Recently, Councilman Erickson journeyed to Olympia for the purpose of inducing the state to purchase $500,000 of municipal railway bonds, the balance of the $800,000 municipal railway issue. The state declined to purchase these bonds, but consented to the city redeeming $50,000 of the $400,000 municipal lighting issue which it held.

The plan to redeem $50,000 of the bonded indebtedness of the lighting department is well conceived to mislead the public into the belief that the lighting department is, unaided by the taxpayers, paying its way and is strictly on a cash basis. This refunding plan of Mr. Erickson's will result in a direct loss to the taxpayers. Recently the people authorized an issue of lighting bonds amounting to $425,000 to install a steam plant. These bonds draw interest at 5 per cent. This resolution now proposes to redeem $50,000 of the 3¼ per cent bonds, which do not mature until 1923, and issue $425,000 of 5 per cent bonds for a steam plant. The lighting department owed the general fund on December 31, 1913, for interest advances for the years 1911 and 1912, $264,348.52.

The financial report of the department shows on December 31, 1913, under liabilities, the sum of $222,346.94 due the general fund for cash advanced to pay interest on lighting bonds for the years 1911 and 1912 and for miscellaneous interest. It is very evident that the department is not paying out of earnings, interest on lighting bonds, and that taxes are being collected from the people to pay this interest.

Respectfully,
A CONSTANT READER.

Seattle, Wash., July 24, 1915.

THE TELEPHONE PROBLEM.

(Discussion by San Francisco Section American Institute of Electrical Engineers of D. P. Fullerton's paper as published in this journal July 18 and July 25, 1914.—The Editor.)

The Chairman (A. H. Griswold): Mr. Fullerton has touched briefly upon many points of the telephone business which could be elaborated almost indefinitely. I recall a little story: A doctor in New York called a doctor in Boston. The operator soon informed him that the fellow doctor in Boston was not in. The New York doctor started to walk away, and the operator said "35 cents please." He said, "What for? I didn't get my party." She said, "No, but the company used $300,000 worth of plant to find out that so and so in Boston was not in." Now, she was a pretty good operator who was able to tell the doctor that the company had employed expensive apparatus, material and construction, to find out whether Dr. so and so in Boston was in or not. The average operator perhaps would not have done that; but the New York doctor paid his 35 cents and felt satisfied.

On the point regarding the services for which the telephone company is often blamed, you may perhaps be interested in knowing that it is easier and quicker for an operator to complete your connection than to tell you the line is busy. It takes her more time and it is harder work for her to inform you that the line is busy than it is to give you your party.

Another interesting point in the service is the human element in the operating part of the business. Mr. Fullerton said that the operators were put in school and trained for some weeks for the operating service. They are not only put in school, but they are paid to go to school. I don't know what the amount is now, but it used to be a dollar a day to go to school; and their wages increase from that up according to their efficiency and the length of service with the company, and yet many of those operators, those same girls, prefer to go in a department store, and stand on their feet all day and work for $6 or $8 a week rather than work in an exchange for considerably more than that. The average wage is $40 or more; and their facilities are splendid. They have nice retiring rooms; lunches are provided on the cafeteria plan, and at very reasonable rates. It is interesting to note that for some time after the fire the average time that an operator worked for this company was five months. It is perhaps the human element of the business that enters into that—the desire to see people and talk with them.

Party line service, is a very necessary part of our business. It is necessary, as Mr. Fullerton stated, that we develop all classes of service. We advertise universal service—service to everybody; and it is necessary that the cheap service as well as the expensive service be provided. Now it is difficult to make people getting the cheaper service realize that they are not entitled to get the same class of service as the man who is paying for the more expensive type; and it is particularly difficult due to the fact that the majority of the people who are getting the cheapest type of service are not perhaps as well educated or able to realize the reason why the higher class or more expensive type of service should be better. Mr. Fullerton spoke also of the hotel service and the private branch exchange service, and how the company is frequently blamed for errors for which it was not responsible. I would like to take this opportunity to call your attention to the fact that the board of supervisors has passed an ordinance that any man owning a private branch exchange can hire anybody he pleases to operate that exchange—his grandmother or grandfather, or anybody else. Now the average individual who is calling that private exchange does not recognize that somebody's grandmother is operating it, and he looks to the telephone company for that service. Prior to the passing of that ordinance we used to provide those operators, who were trained in the business

and capable of handling that service. We are no longer able to do so, only with the larger users, who recognize the necessity for proper service, and require that we provide them with trained operators.

It might be interesting to some of you to know the limit of error of telephone apparatus. There is in each connection a great number of relays, repeating coils and condensers, and lamps and plugs and cords, and various things of that sort, and a great many soldered connections—in fact many things that might interfere with the service; and yet the percentage of actual calls that went wrong due to circuit trouble is .2 of 1 per cent in San Francisco. When you consider the amount of apparatus and the number of connections required in each call, that is a very low percentage.

A. H. Halloran: It has been interesting to hear of somebody else's troubles. Each one of us thinks that our business has a monopoly of the troubles; and I know that some of the electric power men sitting here have been reminded of similar troubles of their own. Likewise the street railway men are up against the same proposition—that of dealing with the public.

The study of human nature is perhaps the most difficult matter that an engineer has to face. An engineer is used to dealing with materials; his training, except in construction work, does not lead him into dealing with men, with individuals; and when he meets such troubles, he is sometimes at a loss to know just what to do. Tonight Mr. Fullerton and Mr. Griswold have done the very thing that is necessary, and should be done on every occasion; they have come forth and frankly told their troubles, and told of the ways in which they are trying to remedy them. The least each one of us here tonight can do the next time someone complains about the telephone service is to tell some of the things we have learned tonight, and in that way carry on the good work and try to educate the public to the difficulties of this one of the means of serving them.

Thos. Morrin: The telephone business is suffering greatly from the fact of there being absolutely no regulation or control of the use of party lines. I myself have a telephone at home on a party line. I did not feel that I could afford to pay the regular rates, because our service I feel is carried on honestly and conscientiously, within a reasonable limit for the use of the telephone. It is seldom, if ever, that I use it for business purposes unless compelled to; it is used exclusively for household purposes, and by my family only; but we have a great annoyance; and it is very frequent that the other party uses the 'phone for unlimited time; when I say half an hour or an hour at a time I think that is quite ordinary; and there is no possible pleading or influence that we can bring to bear on those parties to allow us, even in an emergency, to use the 'phone for a few minutes, with the privilege of their resuming their conversation later when we are finished. I think, in all honesty to the user and the company, that there should be some means of regulating the party line service so that there would be a fair equality to all parties concerned.

D. P. Fullerton: A few weeks ago we had some heavy storms in the southern part of the state, and one of the telegrams that came in from one of our repairmen located away up the mountains was worded this way: "I want to report that the lines over the Liebre mountains are in a terrible state of condition." That is the position I am in tonight. I am billed for one story, that is, the secretary gave me a paper with one heading tonight; I gave it another, and the paper did not have anything to do with either one of them. I am in a rather "bad state of condition," but for the benefit of Mr. Morrin I want to say this: I think I should have called my paper "The endeavor of the company to do a Christian like job, or the claim that very few people know how to use a telephone." Unquestionably Mr. Morrin knows how to use a telephone, but the party alongside of him does not. That is a thing that I tried to cover in my paper tonight. Those are the very things that I quoted in this paper from the decision of the railroad commission of the state of Michigan, and they were unable to correct them in any way. The complaint in Detroit was on account of the interference with service, just as you have complained of. The commission went into it, as I quoted in this paper. The contract that you and your fellow subscriber in Michigan signed stated that you were to have, each one of you, four calls a day and that neither of you were to use the telephone over five minutes at a time. You made that agreement just the same as you would make an agreement to lease a house or any other class of business.

We would like to enforce the contract; but I think a little study on the part of anyone here tonight will show that it is almost impossible.

Our great trouble is educating the public; and I will say—and I am not speaking with any animus in any direction towards anyone—our trouble is we do not get the proper support from the properly constituted governing bodies. An instance occurred a few weeks ago. There has been a row in Denver between the people and the telephone company there for some time. A telephone engineer of any experience will tell each and every person that a measured service is the most equitable service. Simply referring to other utilities, when you ride on the railroda you pay so much a mile; when you burn these electric lights you pay so much a kilowatt. When you use your gas you pay so much a foot. When you send your letters you pay so much per ounce or half-ounce—everything is measured except the telephone. Everybody wants all of that for the least amount of money that he can get it. Denver, Colo., was on an entirely measured rate basis, and the cheapest measured rate service in the world; but less than one month ago, without any study, but just a hue and cry from the untrained public, demanded and wiped out all of those reasonable rates, which put the burden on the one that used the telephone, that gave the small burden to the small user, and the big burden to the big user—wiped that all out and established a flat rate, that makes the little fellow carry the burden for the big man. I am satified that I can convince—or any engineer can convince you that the system of rates in Denver was proper.

I was glad that one of the speakers took up the question of the method of using the telephone. One of the great troubles that we have is to get people to talk directly into the telephone. Years ago, when I was introduced to anybody and was asked what my business was, I generally threw up my arm and told him I was a telephone man, because I was afraid he was going to give me a wallup. Nowadays he generally says, "What is wrong with my telephone service?" and I tell him right off that he does not know how to use the telephone. Everybody should take the advice of a telephone man as to how to use a telephone. You don't go to the lawyer when you are sick; you go to the doctor. You don't go to the doctor when you are in trouble with your neighbor; you go to the lawyer for advice. Why not go to the telephone man for advice as to how to use the telephone. It will lessen our burdens. The speaker was right when he told about the fellow who holds the telephone at one side and tries to talk in the opposite direction. The telephone is made to talk into. Another thing to bear in mind is that the telephone is made to be answered. It is not made to be put on the wall and ring while you keep talking to someone here. In your own place of business, if you are talking to someone of no moment and a customer comes in, you leave him and go to attend to the customer. You don't know what is on the other end of a telephone. A telephone is a thing to be answered instantly. I don't care who is in my office talking to me when the telephone rings; I even don't ask him to excuse me. I grab the telephone; and I think you will find it is mighty good telephone courtesy to follow that rule.

Thereupon the meeting adjourned.

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CONTENTS

Irrigation Manager and His Legal Problems 95
By F. H. Newell.

Electric Brass Making Furnaces 95

Hydroelectric Development on Public Lands in Relation to Irrigation 100
By E. C. Finney.

Denatured Electricity 101

Efficiency Engineering for a Power Company 102
By E. A. West.

Pumping California Oil 104

The Waste of Water in Irrigation 104

U. S. Government Exhibit at Panama-Pacific International Exposition 104

History of Electric Transmission 105
By G. O. Wilson.

Letter to the Editor 106
Criticism of Seattle Municipal Lighting Plant.

The Telephone Problem 108
Discussion by Members S. F. Section, A. I. E. E.

Editorials 110
Teaching the Public.
Western Water Legislation.

Personals 112

Meeting Notices 113

Roster of the Jovian Order 113

Electrical Contractors' Convention, Sacramento, Aug. 4-8, 1914 114

News of the California Railroad Commission 115

News of the Arizona Corporation Commission 115

Trade Notes 115

New Catalogues 116

Industrial 117
Mathias Klein & Sons' New Plant.

News Notes 118

Western Water Legislation

In connection with the leading article in this issue wherein Mr. F. H. Newell, director of the U. S. Reclamation Service, makes the statement "the water laws in many of the states are very defective, being unsuited to the needs of the people," the situation in Oregon and in California is of present peculiar interest.

In Oregon Governor West is alleged to be endeavoring to abolish the office of state engineer and the desert land board because of political reasons by means of an initiative measure which will come up at the next election. Strong opposition has been developed among many of the engineering and commercial organizations in this attempt to do away with what is generally believed to be the most efficient and satisfactory administration of water laws.

In California the situation is reversed, as an opposition is endeavoring to defeat a water commission bill to be referred to the voters under the referendum. A short review of the situation with special reference to conditions to be remedied in California may be of interest.

The necessity for a modern water code has been felt in California for many years.

The existing law is a hybrid, without pride of ancestry nor hope of posterity, a grafting of the old English common law of riparian rights onto the deeper-rooted stock of the law of appropriation. For in the West the right of prior use established by the early California miners, antedates the riparian doctrine, imported by the American colonists from England and now firmly entrenched by judicial decisions. Under its provisions, title has been insecure, litigation has been protracted, the distribution of water use has sometimes been inequitable and new developments have been retarded.

Relief is needed.

The proposed law establishes a commission authorized to determine the status of all water rights now in use and prescribes the procedure in appropriating new rights. Any water not in active, present, beneficial use is subject to appropriation at any time, excepting that a continuous period of ten years of non-use is allowed to lands riparian to a stream before this water may be appropriated. The several steps to be taken in the acquisition of rights are fully detailed, from the time a permit is applied for until a license is granted after the commission is satisfied. A filing fee is required; $500 for power development of from 100 to 10,000 horsepower, and $1000 for greater development, together with an annual license fee of twenty-five cents for each theoretical horsepower capable of development; for other than power purposes, the filing fee is $10 and the annual license fee ten cents per miners' inch. After twenty years' private use provision is made for public purchase at a price to be fixed by eminent domain pro-

ceedings. Water rights cannot be capitalized and court review is provided for all commission decisions and revocations.

All those who are well informed about the present conditions agree that the new law will instill scientific management into a procedure now lacking in system and efficiency. It involves practically no new principles, being merely a declaration of the law already defined by the courts.

Much opposition centers about its virtual abrogation of the unused riparian right; whereby the owners of land along the lower stream have been able to prevent the more beneficial application of the water to other lands even though the water is not being used on the riparian lands. Yet the right of appropriation seems to be far better adapted to the needs of irrigation and power development, with which the prosperity of these Western states is so intimately intro-locked. Considered from the standpoint of obtaining a maximum economic production at a minimum waste the new bill is intended to bring about true conservation and equity. The broad humanitarian aspect of this question is admirably treated in the leading article of this issue by Mr. F. H. Newell.

But while its evident intention is good its execution is poor. The law might be better administered, and at less expense, by a bureau of the state department of engineering than by a new commission; the qualifications of the commissioners are not clearly prescribed, and other features have been overlooked by its framers.

Although the suggested remedy cannot boast of its antecedents and although tainted with grave suspicions as to its job-creating effects, it still has much good. It represents a great stride forward toward a modern water code, it puts order into chaos, and its omissions can be readily remedied by future amendment. However, its only hope for passage lies in a broad campaign of education among the voters who are indifferent to its effects and likely to defeat it because of their ignorance, for as a whole it seems worthy of support just as the present attempt in Oregon seems worthy of defeat.

Teaching the Public

"The greatest problem which confronts the (telephone) engineer is to devise a plan to systematically and efficiently educate the public in the use of a (telephone) system." The quotation is from D. P. Fullerton's paper on the "Telephone Problem" recently published in these columns, with the exception that the parentheses are supplied by the editor. In fact, Mr. Fullerton's paper can be re-read with profit by substituting "gas," "electric" or "railway" wherever telephone is mentioned.

All of these great public utilities are designed, constructed and operated by engineers, and it might well be the engineer who teaches the public how to use them to the best advantage. And yet this teaching the public is a far more difficult problem than is generally imagined.

There are many subjects upon which the publc need education—the mechanical difficulties in supplying service, the cost of establishing the utility, the long period of no returns on invested capital, the fair profit on a hazardous business, the necessity for engineering public service commissioners, the false professions of politicians, and finally the best methods of using the service.

The problem is primarily one of engineering salesmanship—engineering, because of the requisite technical knowledge; salesmanship, not of a commodity, but of a service.

The approach should be through every channel by which the utility comes in contact with the public. The man who takes the order for service connection should realize that his order is only the beginning and not the end of the service. The workman who makes the connection, the clerk who makes the collection, and every employee who deals with the public should realize that service must be maintained.

Service depreciates from many causes besides deterioration of equipment. Courtesy and public interest do much to build up confidence and to attract favorable attention. Such spirit should be the particular characteristic of all publicity which the company is given, whether through the press, by means of lectures or with house organs. Courtesy does not mean weakness. When the time arrives for a positive, courageous opinion, it should be given through all these channels with certainty and force.

Mass education is impossible. Public opinion is merely the integration of the differentials or derivatives of many individual opinions. By teaching enough individuals it is possible to finally educate the whole public. This great public is your neighbor. You know that the family next door and the family around the corner are human. You call them your neighbors, you treat them with courtesy and honesty in your personal dealings. They are your neighbors and your friends; they are your public.

The public's failure to comprehend the conditions under which the utility is working is the real cause of the strained relations which too frequently exist between the server and the served. The American people, particularly, are characterized by the spirit of fair-play, and when they know the difficulties under which the utility companies are working they will give the sympathetic hearing which is now denied.

The blame for this popular ignorance lies with the utility. More harm has been done by the policy of silence than by all the attacks of favor-currying demagogues. Good-will can be cultivated as scientifically as oranges; ill-will can be overcome like any other disease which thrives in the dark. Free, frank, open publicity, the bright light of truth, concentrated intensively on segregated individuals, will cause good-will to blossom and ill-will to wither. Suspicion breeds in the darkness of ignorance, confidence flourishes in the light of knowledge.

These ideas are but suggestions for a scientific plan to be followed in securing the co-operation of the public with the company in furnishing satisfactory service. The details must be worked out to fit the needs of each community, but it is believed that these general principles are universally applicable. They show that better public relations can be established by effective publicity, which is largely a matter of engineering psychology, an intelligent directing of the forces which move the human mind.

PERSONALS

W. R. Pounder, representative of Hubbard & Co., at San Francisco, has returned from a trip through Oregon.

R. E. Frickey, engineer with the Northern California Power Company, Redding, Cal., spent the past week in San Francisco.

H. A. Miller, a contractor of Pasadena, California, spent a few days in San Francisco enroute to his home town from a visit to Alaska.

T. E. Bibbins, local manager General Electric Company, San Francisco, is on an extended trip through the mountain region of California.

P. B. Hyde, representative of Thos. A. Edison Company, San Francisco, left during the week for an extended business trip through the Pacific Northwest.

H. H. Hughes, salesman with Westinghouse Electric & Manufacturing Company, San Francisco, has returned after a two weeks' trip to Monterey Bay region.

W. W. Lane of the Western Electric Company's Los Angeles branch, has returned from an extended trip to Honolulu, where he combined pleasure with business.

George D. Smith, supervisor of agencies of the General Vehicle Company, New York, was at Seattle, Wash., during the past week, and also visited British Columbia.

G. B. Rosenblatt, in charge of mining operations for Westinghouse Electric & Manufacturing Company, located at Salt Lake City, was a recent visitor to San Francisco.

Ben Mitchell, engineer for the Utah Copper Company, Salt Lake City, who has been in California for several days, left San Francisco during the past week for home.

A. J. Moan, general manager specialty department, H. W. Johns-Manville Company, New York, is a recent arrival on the coast and recently spent several days in San Francisco.

O. A. Schlesinger, manager San Francisco office United States Light & Heating Company, is visiting the Pacific Northwest and was at Vancouver, B. C., during the past week.

H. W. Turner, president of the Washington Electric Supply Company, at Spokane, and of the Montana Electric Company at Butte, has returned to Butte from a visit to Seattle.

Arthur Walser, district manager motor department of the General Electric Company at Denver, has returned from a visit to the company's factories at Schenectady, Pittsfield and Lynn.

Alex. Friedman, manager Titan Electric Supply Company, Montreal, Canada, is at Vancouver, B. C., with the object of starting a Western branch for the company in the Pacific Northwest.

J. W. Young, representative of the Kerite Wire Company, New York and an old time signal engineer is visiting the Pacific Coast on a business trip and spent last week in San Francisco.

G. Douglas Jones, electrical engineer, with the state engineering department, Sacramento, Cal., who has been spending the past two weeks in San Francisco, returned home the latter part of the week.

Hylon T. Plumb and **Robert Miller,** engineers in the Salt Lake office of the General Electric Company have recently returned from a meeting of the company's engineers at Schenectady and Pittsfield.

H. W. Cope, director of exhibits Westinghouse Electric & Manufacturing Company for the Panama-Pacific International Exposition, San Francisco, is at Pittsburg on matters pertaining to the exposition.

Kenneth Macken of Talton Place, Vancouver, B. C., who has been attending the Rensalaer Polytechnic Institute for the past four years, has returned to Vancouver, having received his degree in electrical engineering.

John Montgomery, commercial agent of the Western Canada Power Company, with headquarters at Vancouver, has been visiting with old acquaintances in Salt Lake City during the past week in the course of a three weeks' vacation.

Miss Laura C. Addison, electrical economist with the Washington Water Power Company, Spokane, Wash., will demonstrate the advantages of electric ranges to prospective purchasers. The company has purchased from the General Electric Company 100 ranges.

E. J. Simons, manager The General Machinery Company, Spokane, Wash., purchased from the Washington Water Power Company during the past week $190,000 worth of second hand machinery and construction equipment, and 54 cars have been requisitioned to bring it into the city from the Long Lake dam site.

E. L. Dee, special lamp salesman for the Western Electric Company's Salt Lake office, left this week for Cleveland to attend the convention of Sunbeam lamp salesmen at Nela Park. Mr. Dee has been specializing for the past two months on the sale of the new Type C Mazda units for exterior lighting purposes among the merchants of Salt Lake City and has been highly successful.

F. J. Bell, manager Canada Wire & Cable Company, Toronto, Ont., was at Vancouver, B. C., during the past week in conference with **J. B. Sunderland,** electrical department of Macdonald Marpole Company, distributing agents for the company for British Columbia and the Yukon. While at Vancouver Mr. Bell made arrangements whereby Messrs. Chapman & Walker will be the selling agents for the company's rubber covered wire in this territory.

Thos. G. Grier, western manager of Harvey-Hubbell, and vice-president of the 1900 Dry Battery Company with headquarters at Chicago, stopped off at Salt Lake City last week on his return trip through the Yellowstone National Park. Mr. Grier is a pioneer electrical manufacturer's agent and recalls with pride the fact that he sold the entire electrical equipment for the celebrated Salt Lake Temple which was in course of erection for forty years, and completed in 1890.

A. W. Peard, sales manager of the Spencer Turbine Cleaner Company of Hartford Conn., is in Salt Lake City in connection with several important vacuum cleaner contracts which are to be let in the near future. His company works through the Capital Electric Company, and after completing his work here, Mr. Peard will visit the capital's various branch houses of the company in order to familiarize their branch salesmen with the merits of his company's products.

W. S. Turner, consulting engineer at Portland, Ore., has been appointed chairman of the Portland reception committee to entertain visitors passing through Portland, while visiting the Pacific Coast in connection with the International Electrical Congress to be held at San Francisco in 1915. The other members of the committee are: **O. B. Coldwell,** Portland, Railway, Light & Power Company; **H. M. Friendly,** Spalding Building; **F. W. Hild,** Portland Railway Light & Power Company; **Paul Lebanbaum,** Portland, Eugene & Western Railway Company; **L. Y. Kerwin,** Northwestern Electric Company; **R. F. Monges,** General Electric Company; **A. S. Moody,** General Electric Company; **W. D. Scott,** The Pacific Telephone & Telegraph Company; **H. R. Wakeman,** Portland Railway, Light & Power Company; **C. L. Wernicke,** Westinghouse Electric & Manufacturing Company; **F. D. Weber** Underwriters' Equitable Rating Bureau; **C. F. Nock,** The Pacific Telephone & Telegraph Company; **B. C. Condit,** Northwestern Electric Company, and **J. W. Martin,** Pacific Power & Light Company.

MEETING NOTICES.

Alameda County Electrical Development League.

The regular monthly meeting of the Alameda County Electric Development League was held on July 25th at the Saddle Rock cafe in Oakland. President Geo. Furniss presided, there being an attendance of over thirty members. The paper of the day on Indirect Lighting was presented by R. E. Smith of the National X-Ray Reflector Company.

The Southwestern Electrical & Gas Association.

At a meeting of the executive committee of the Southwestern Electrical & Gas Association, held at the office of the Association, 405-6 Slaughter Building, Dallas, Texas, July 18, 1914 it was unanimously decided that the next annual convention of the association would be held in Galveston, Texas, May 19, 20, 21 and 22, 1915, the Hotel Galvez to be convention headquarters. Further information with regard to this may be obtained from the secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas.

Salt Lake City Electrical Contractors.

"If you would know a man, eat breakfast with him," says the old adage. If it is not convenient to eat breakfast with him do the next best, eat luncheon with him, so believe the electrical contractors of Salt Lake City. In order to become better acquainted socially and consequently to promote a freer and closer business relationship, the electrical contractors of Salt Lake City for the past several months have been eating their luncheons together three times a week at the Commercial Club. They convene promptly at 12 o'clock and close promptly at 1:00. If matters affecting the electrical industry require attention, these are discussed, as for example: The commission of Salt Lake City is proposed to revise the present electric sign ordinance, and after discussion it was found that while in the main this sign ordinance was a decided improvement over the old one, that there were certain features which would work to the disadvantage of sign users, and consequently to the electrical industry. A committee was appointed, therefore, to wait on the city commission and explain the situation with the view of having the necessary remedy made.

Pacific Coast Convention A. I. E. E. and N. W. Electric Light & Power Association.

A joint parallel meeting of the sixth annual Pacific Coast convention of American Institute of Electrical Engineers and of the Northwest Electric Light and Power Association will be held at Spokane, Wash., September 9, 10 and 11, headquarters being established at the Hotel Davenport.

The A. I. E. E. program as arranged tentatively will be as follows:

September 9th.

Morning—Office open for registration. Joint opening meeting, with addresses of welcome followed by a separate session with paper and discussion.

Afternoon—Separate session with papers and discussion. Reception by the Ladies' Reception Committee to the visiting ladies at the Davenport Hotel with afternoon tea.

Evening—Joint Smoker with members of N. W. E. L. & P. Association with Dutch lunch. Theater party for visiting ladies.

September 10th.

Morning—Separate session with papers and discussion.

Afternoon—Joint session with N. W. E. L. & P. Association with papers and discussion. The papers for this session will be furnished by members of the N. W. E. L. & P. Association. An automobile trip around the city for the visiting ladies, ending at the Country Club where afternoon tea will be served.

Evening.—Joint meeting with an illustrated lecture by A. H. Halloran on the Electrical Features of the Panama-Pacific Exposition and a Presentation of the International Electrical Congress, followed by a musical entertainment and buffet luncheon. This meeting will include the ladies as well as the men.

September 11th.

Morning—Separate session with papers and discussion.

Afternoon—Separate session with papers and discussion. Automobile trip for the ladies to Hayden Lake with afternoon tea served at Bozanta Tavern.

Evening—Joint banquet for men. Theater party for the visiting ladies.

September 12th.

Joint excursion by automobile to Little Falls and Long Lake, including ladies.

September 13th.

Joint trip over part of the Inland Empire Railway System to the Palouse country and Coeur d'Alene Lake, including ladies.

The proposed papers for the Northwest Electric Light & Power Association are as follows:

"Rates and Physical Valuation," by W. W. Cotton of the Portland Bar. "A Balance of Stores System for Light & Power Utilities," by Edward A. West, Portland Railway, Light & Power Company. "Out of Door Type of Transformer Stations," by J. C. Martin, Pacific Power & Light Company. "Rates: A Resume and Comparison of Rate Theories," by Stacey Hamilton, Portland Railway, Light & Power Company. "Extension of Electric Service Into Small Country Communities and Rural Districts," by M. C. Osborn, Washington Water Power Company and J. E. Davidson, Pacific Power & Light Company. "Wrinkles," by P. A. Bertrand, Grays Harbor Electric Company. "Electric Power Development on the Pacific Coast," by W. E. Herring, Puget Sound Traction, Light & Power Company. "Electric Appliances," by H. B. Peirce, The Washington Water Power Company. "Organization and Operation of Branch Offices and Plants," by Lewis A. McArthur, Pacific Power & Light Company. "Public Policy Review,' by F. T. Post, The Washington Water Power Company.

The papers by Messrs. Cotton and Martin will be presented at the joint session.

The papers promised for the institute meeting are as follows:

"A Distribution System for Power Purposes," by F. D. Nines, Vancouver, B. C. "Electrical Application in the Lumber Industry," by E. F. Whitney, Portland, Ore. "Operation of the Butte, Anaconda & Pacific 2400 Volts D.C. Railway," by I. B. Cox and C. A. Lemmon, Schenectady, N. Y. "Considerations in the Application and Control of Electric Motors for Gold Dredges," by G. B. Rosenblatt, Salt Lake City, Utah. "The Effect of Delta and Star Connections upon Transformer Wave Forms," by Prof. Leslie F. Curtis, Seattle, Wash. "Economy in the Operation of 55,000 Volt Insulators," by Magnus T. Crawford, Seattle, Wash. "The Big Creek Development of the Pacific Light & Power Corporation," by Ed. Woodbury, Los Angeles, Cal. "A Report of the Work Done by the Joint Committee (California) on Inductive Interference With Telephone Lines," by A. H. Griswold, San Francisco, Cal.

"ROSTER OF THE JOVIAN ORDER."

Mr. E. C. Bennett, Mercury for the Jovian Order, has just issued the 1913 Roster, containing the names of the 12,282 members who had joined up to December, 1913. This interesting and valuable book contains the list of members arranged alphabetically, potentially, and geographically, and constitutes the best "Who's Who" in the electrical industry that has yet been published. The volume contains over seven hundred pages of condensed information of value to everyone in the electrical business. On account of the expense of issuing the book, a nominal charge of $2.00 is made for this invaluable traveling companion.

ELECTRICAL CONTRACTORS' DEPARTMENT

CONTRACTORS' CONVENTION AT SACRAMENTO.

Arrangements have been practically completed for the fifth annual convention of the California Association of Electrical Contractors at Sacramento, August 4, 5, 6, 7 and 8. An attractive program has been prepared, fine speakers secured and a large attendance is anticipated. Among important matters which are to be discussed are the state license law, the segregation law, and more active work of the committee of jobbers and contractors.

At the open meeting on Friday, August 7th, papers will be read by John A. Britton of the Pacific Gas & Electric Company; W. W. Briggs, of the Great Western Power Company; Carl Heise, Westinghouse Electric & Manufacturing Company; and C. F. Butte, of the Contractors' Association. W. Bailey will talk on Electrical Contracting Accounting. H. V. Carter, president of the Pacific States Electric Company and A. E. Elliott, secretary of the jobbers' association, will speak, as will also C. A. Herrold, an architect of Sacramento, and T. R. Hunter, consulting engineer at San Francisco.

The program is as follows:

Tuesday, August 4, 1914.

9:00 a. m.—Executive Committee meeting; 2 p. m.—Executive Committee meeting.

Wednesday, August 5, 1914.

9 a. m.—Meeting for members only; 2 p. m.—Meeting for members only; 1:30 p. m.—Boat ride for ladies down the Sacramento River in privately owned cruisers; 8 p. m.—Reception and dance at Sacramento Hotel, during the evening a very interesting series of lantern slides of the Lake Spaulding Dam will be shown through the courtesy of Mr. G. C. Holberton, of the Pacific Gas & Electric Company.

Thursday, August 6, 1914.

9 a. m.—Meeting for members only; 1:45 p. m.—Auto ride for all, leaving the hotel going direct to Folsom passing the large gold dredgers of the Natomas Dredging Company, and showing Folsom Prison, thence to Orangeville Colony, where a basket of Superior California fruit will be presented to all, leaving Orangeville will go to Fairoaks by way of the winding way and returning to Sacramento via the Auburn Boulevard; 8 p. m.—Moonlight boat ride and dance on the Sacramento River a light lunch will also be served.

Friday, August 7, 1914.

10:00 a. m.—Open meeting; the public is invited; 2:00 p. m.—Open meeting; the public is invited; 1:30 p. m.—The ladies will be entertained by a sight-seeing trip about the city in electric coupes; 7:30 p. m.—Annual dinner.

Saturday, August 8, 1914.

8:30 a. m.—Annual outing, boat leaves city wharf at the foot of M street, at 8:30 sharp, arriving at Smith's Mound at 10:30 a. m.; 10:30 a. m.—Bamboo rods will be distributed to all wishing to enter the fishing contest, that will last the entire day. Prizes will be given as follows: Lady catching the largest fish; lady catching the largest number of fish; gentleman catching the largest fish; gentleman catching the largest number of fish; W. C. Dolan in charge of arrangements, W. S. Hanbridge, J. W. Hooker, official judges; 11:00 a. m.—Ball game, Wm. Goodwin, manager; Southern California Contractors vs. Northern California Contractors; the contractors' cup is at stake on this game and prizes as follows: Player making the most runs, player making the greatest number of errors will be fined $1.00, to be given to the player making the most runs; Charles Graham, umpire; 12:30 p. m.—Individual lunches will be served to all in the grove along the river bank; 1:00 p. m.—Volunteer pillow contest, C. V. Schneider in charge, Newton Graham, Carl Heilbron, judges; a valuable prize will be awarded to the winner of this contest; 1:30 p. m.—Races. There will be three races for the ladies and the winner of each race will receive a prize; Carl Lamus in charge; Mrs. C. R. Gill, Mrs. S. B. Gregory, judges; 2 p. m.—Men's three-legged race, 100 yards; a prize has been arranged for the winning team; Carl Lamus in charge, Mr. Holabird, Chas. Hillis, judges.

2:15 p. m.—Men's sack race, 100 yards; three prizes. All entrants not finished will be awarded a box of fruit. L. A. Schloss in charge; Wm. Berry and Arthur Rowe, judges. 2:30 p. m.—Ball game; Wm. Goodwin, manager; Jobbers vs. Contractors. Awards same as morning game. The Jobbers' cup is also at stake on this game. 3 p. m.—Children's races; L. A. Schloss in charge. All children entering the races will receive a prize. 3:15 p. m.—Children's races; L. A. Schloss in charge. 4 p. m.—Closing of the big fishing contest and judging to take place in front of the grand stand; W. S. Hanbridge, J. W. Hooker and W. C. Dolan, judges. Music and dancing throughout the entire day. Music by a five-piece orchestra. 4:30 p. m.—Boat leaves for return trip to Sacramento. 8:00 p. m.—Jovian Rejuvenation at Elks' Hall under the direction of G. Stanley Pearce, Statesman. 8:30 p. m.—Ladies will be entertained at whist in the parlors of the Sacramento Hotel. Mrs. C. V. Schneider in charge. There will be three prizes for the ladies winning. There will be three gate prizes awarded at the picnic.

COMMITTEES.

Finance.

J. C. Hobrecht
R. M. Bettens
A. P. Peck

Printing.

H. F. Yost
W. C. Dolan

Publicity.

W. C. Dolan

Boat Ride for Ladies Down the River, August 5th.

Homer Moore
Mr. Lewis
Mr. MacAvoy
Harry Sayles
Miss E. Meyers
Mrs. G. S. Pearce
Mr. R. E. Fisher

Reception and Dance, August 5th.

L. A. Schloss
C. W. McKillip
Arthur Rowe
C. W. Wheeler
Geo. C. Holberton
D. W. Carmichael
A. J. Brown

Auto Trip to Folsom, August 6th.

C. R. Gill
Carl Vining
Mr. Libbey
John Lidemeyer
S. B. Gregory
Mr. Camp
Mrs. Tom Scott

Moonlight Boat Ride and Dance, August 6th.

R. L. Douglas
C. W. Allen
Carl Hoskinson
W. R. Dunbar
Frank Fowden
Mrs. W. H. P. Hill
Mrs. C. W. McKillip

Auto Trip for Ladies Only, August 7th.

Carl Lamus
Mrs. Stauffer
Mrs. Ben Leonard
Mrs. J. Grant Black

Annual Banquet, August 7th.

C. S. Pearce
H. E. Sanderson
H. E. Herr
C. D. Herbert
Mrs. C. V. Schneider
Mrs. Carl Lamus

Annual Ball, August 7th.

T. J. Dillon
C. W. Hall
R. E. Griggsby
Mr. Henkle
Newton Graham
Harry Daly
Arthur Rowe
E. W. Beardsly
Mrs. Ross L. Douglass
Mrs. J. C. Hobrecht
Miss Louise Schmeiser

Annual Outing, August 8th.

J. C. Tobey
J. H. Fagg
M. J. O'Connell
C. L. Gibson
Carl Beaton
Mrs. C. R. Gill
Mrs. H. E. Herr

Prizes for Outing, August 8th.

A. P. Peck
G. G. Doty
A. E. Drendel

Ladies Card Party, August 8th.

Mrs. C. V. Schneider
Mrs. C. R. Gill
Mrs. C. S. Pearce
Mrs. J. Crombach
Mrs. Sloss
Mrs. Tom Scott
Mrs. Dolan
Mrs. Ross L. Douglas
Mrs. T. J. Dillon

Reception.

Tom Scott
C. V. Schneider
W. B. Hall
C. W. McKillip
C. C. Davis
C. E. Wiggin
H. F. Schultz
C. B. Hall
Newton Graham
Miles Steel
S. A. Baker
H. B. Squires
Bert Hanson
J. H. Murray
L. A. Sloss
P. B. Hyde
Geo. A. Gray
A. J. Coffee
W. H. P. Hill
L. S. Somers
Chas. Graham

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Oakland, Antioch & Eastern Railway has filed an application with the commission asking authority to issue $900,000 of 6 per cent convertible gold notes to be secured by its first mortgage 30 year gold bonds in ratio of 2 to 1. The notes are to be convertible before maturity at the holder's option on the basis of 80 per cent of the par value of the bonds and accrued interest as against the par value of the notes and accrued interest. It is furthermore, provided that the notes shall be redeemable in whole or in part at the option of the company on any interest date at face value and accrued interest on not less than 30 days' notice. The company proposes to sell these notes at not less than 96, the proceeds to be used toward paying off floating indebtedness. The company now has outstanding 100,000 shares of common stock, par value $100, and 4355 First Mortgage 30 year gold bonds par value $1000. During the last fiscal year it paid out $280,736.15 in interest.

The Los Angeles & San Diego Beach Railway Company, operating in San Diego, has filed an application with the commission asking authority to issue $825,000 of bonds. These bonds will be secured by a trust deed of all the company's property and are to be used in electrizing certain portions of the railway company's lines, as previously ordered by the commission, and in improving those now in existence.

The commission has rendered a decision authorizing the Southern Counties Gas Company of California to issue 3 year 6 per cent promissory notes of the face value of $240,500. The commission's order provides that these notes shall be issued so as to net not less than 93 per cent of the face value.

The Roseville Telephone Company, operating at Roseville, Placer county, has filed an application with the commission asking authority to issue 50 shares of capital stock of the par value of $10 per share. The company represents that the sale of this stock is necessary to furnish funds to pay for labor and material used for construction since April 1, 1914.

The commission has rendered a decision authorizing the Oro Electric Corporation to renew promissory notes totaling $71,960.23. The money derived from the sale of these notes was expended for the purchase of materials used in the construction of the corporation's system.

The adjourned hearing in the commission's inquiry into the financial condition of the United Railroads of San Francisco, which was set for July 28th, has been postponed until August 14th at 10 a. m. The postponement was made at the request of the company, which asked for further time in which to prepare its figures.

NEWS OF ARIZONA CORPORATION COMMIISSION.

The Tucson Gas, Electric Light & Power Company has been authorized to defer for a period of one year the setting aside as depreciation reserve any portion of the earnings or other moneys. The company has also been directed to amortize in equal monthly payments for a period of 120 months, all proper expenses, allowed and approved by the commission, in the matter of I. E. Huffman et al., complainants, vs. Tucson Gas, Electric Light & Power Company.

The Globe & Miami Traction Company has been given permission to sell 7500 shares of its capital stock, for not less than 90 per cent of its par value of $10 per share, and the proceeds shall be applied solely in building an interurban car line between the towns of Globe and Miami, in Gila county, Arizona, a distance of approximately 6.7 miles, authorization having also been given to exercise its franchise.

The Tucson Gas, Electric Light & Power Company has been authorized to advance the Tucson Rapid Transit Company $40,000 for the purpose of making certain improvements, betterments and extensions to its street railway system in the city of Tucson.

The Nebo Electric Light & Power Company has been granted a certificate of convenience and necessity to construct, maintain and operate an electric light and power plant in the town of St. Johns, Arizona, contingent upon prompt construction of the project and completion within a reasonable time.

The commission's General Order No. 37 provides that all telephone, telegraph, signal, trolley, electric light and power lines, now or hereafter constructed within Arizona, shall be constructed and maintained in conformity with the specifications contained in the Report of the Committee on Overhead Line Construction of the National Electric Light Association. Provided, also, that the same general regulations shall apply to all direct current overhead trolley construction and reconstruction of whatever nature within the state. And, further provided, that all lines of aerial wires, or cables, of telegraph, telephone, signal and all other electric wires of similar nature, now or hereafter to be constructed across steam railroad rights of way, tracks, or lines of wire of the same classes, shall be constructed and maintained in conformity with the specifications applying to such classes of wires, cables, or lines, prepared by a joint committee and adopted by the Association of Railway Telegraph Superintendents, in convention at St. Louis, Missouri, May 20, 1913. Modifications and additions to said specifications, made by said N. E. L. A., upon approval first having been made by this commission, shall be in full force and effect with relation to overhead line construction in this state. All telephone, telegraph, signal, trolley, electric light and power lines, now constructed in Arizona shall conform to those specifications, applying thereto, within a period of five years from the date of this order.

TRADE NOTES.

The Great Western Power Company has moved its San Francisco offices from 233 Post street, to 14 Sansome street.

The United Light & Power Company, San Francisco, has removed its offices from the Mechanics' Institute Building, to 511 Sutter street, Press Club Building.

It will perhaps be a matter of interest for engineers to know that since the editorial on "Electric Plowing" appeared in the Journal of July 25th our attention has been called to the design of an electric tractor which meets all the specifications cited.

The Humphrey Gas Engine Pump Company of Syracuse, N. Y., is preparing an exceptionally handsome exhibit for the Panama-Pacific International Exposition which will be of great educational value. It will be located in an advantageous position in the Palace of Machinery and will display in operation some of the latest types of pumping machinery.

The B. C. Steel Works, Ltd., will shortly be established near Bridgeport, Lulu Island, on a site of 5 acres with 300 ft. water frontage. The company is capitalized at $500,000 and will require buildings and machinery to cost $100,000. The works will manufacture merchant bar, angle iron, rounds, flats, bolts, nuts and light rails from scrap which will include wrought iron, steel scraps, turnings, pipe plates, shearings, etc. Francis L. Leighton, manager of the Vancouver Engineering Works, is one of the directors.

The board of education at Salt Lake City has awarded to the Inter-Mountain Electric Company the contract for the electrical cooking equipment for the cafeteria for the new East Side High School which is nearing completion and will be placed in service at the beginning of the next school year. The equipment will consist of two No. 14 Simplex Ranges, one of them to have 2-15 in. discs, and the other to have 1-10 in. disc, 1-12 in. disc, 2-8 in. discs, and 2-6 in. discs, with a complete line of lock-on cooking utensils to fit the various discs. In order to accommodate the large amount of baking necessary an additional baking oven will be furnished. Also a 3 gallon chocolate urn and a 6 ft. electrically heated steam

table, all made by the Simplex Electric Heating Company of Cambridge, Mass. The equipment is intended to be adequate to serve 800 pupils with luncheon.

The Weyerhaeuser Lumber Company of Everett, Washington, has awarded the contract for the power plant generating apparatus, for its new saw mill to Allis-Chalmers Manufacturing Company. The equipment will include one 2000 kw. at 80 per cent power factor horizontal Allis-Chalmers Parsons steam turbine unit of the high pressure condensing type, also one 1000 kw. unit of the same characteristics, both units to be capable of a continuous 25 per cent overload. A 35 kw. impulse turbo-generator unit and a 35 kw. slow speed motor generator set will take care of the lighting and excitation. Both of the main units will be of the latest design of the manufacturers. The generators will be of the enclosed type, the cooling air being taken in and discharged to the basement. The current will be three-phase, sixty cycles at 600 volts. Motors will be used to drive the machinery for the saw, cedar, shingle and planing mills. The order was placed through the Seattle office of Allis-Chalmers Manufacturing Company. This is a noteworthy installation as when completed it will be the largest electrically operated sawmill in the world; the second largest being the Atlantic Coast Lumber Company's mill which is driven by three 700 kw. Allis-Chalmers steam turbine units. The Weyerhaeuser mill is being designed by Mr. A. B. Pracna, consulting engineer, of Seattle, Washington.

In the recent Vancouver, B. C., pageant, the Ross & Howard Iron Works Company, Ltd., float consisted of a section of the penstock made by the company for the Western Canada Power Company. This is said to be the largest in Canada. It weighs 187,751 lb. This pageant, the first of its kind, was held in honor of the convention of the Pacific Coast Advertising Men's Association and the B. C. Lumbermen's concatenation. The B. C. Electric Railway Company's floats were of especial interest, one consisting of the oldest car used in 1889, when the rolling stock of the company consisted of two cars and manned by the crew of longest service, a comparison being made with the present splendid equipment of 231 cars. The other float was appropriately labelled, "The Source and the Service" and consisted of a working model of No. 2 Power House situated at Lake Buntzen on the North Arm of Burrard Inlet. The float was mounted on an electric truck, the current from the storage battery being used to operate a small motor which pumped water from storage tanks through the tail races of the power house during the course of the parade. At each corner of the float were towers each occupied by employes and equipment representing the utilization of energy and the service rendered. The Vancouver Gas Company entered two floats representing the old and the new way of lighting and cooking, also the use of gas for industrial purposes.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces that it has supplied the following apparatus to metal mines during May, 1914: August Mining Company, Landusky, Mont.: Three 75 k.v.a., 11,000 volt, type SK transformers; one electrolyytic lightning arrester; one complete switchboard equipment; one 125 h.p. belted motor for tube mill drive; one 35 h.p. motor for driving rolls; one 25 h.p. motor for driving crusher; one 15 h.p. motor for driving belt conveyor; one 10 h.p. motor for driving air compressor for agitator, two 7½ h.p. motors for driving triplex plunger pumps; one 3 h.p. motor for driving placer firer; four 7½ h.p. slow speed motors for driving slime pumps; complete line material for 23,000 volt high tension line; two 4 k.v.a. type S lighting transformers. Anaconda Copper Mining Company, Boston & Montana Reduction Department, Great Falls, Mont. Four 30 h.p. motors with PB brakes. These motors are to control 8 ft. gate valves in the air line supplying blast to the copper furnaces. Anaconda Copper Mining Company, Butte, Mont.: Three 3½ ton, 18 in. gauge, 250 volt bar steel locomotives with 901-B equipment. The above are to be exact duplicates of locomotives previously furnished this customer, making approximately the fifth repeat order for this class of machine. International Smelting & Refining Company, Miami, Ariz.: Seven 50 h.p. back geared a.c. mill motors with magnetic brakes for operating 12 ft. Great Falls type converters; two 150 h.p. motors for belt driving rolls and crushers; two 25 h.p. back geared d.c. mill motors for Matte casting machines; ten d.c. mill motors with brakes and magnetic control. All of the above apparatus for a new copper smelter. Anaconda Copper Mining Company, Butte, Mont.: Four 7½ h.p. motors for fans; one 25 h.p. motor with double extended shaft for pump; three 5 h.p. motors; one 10 h.p. motor; one 50 h.p. motor; one 100 h.p. motor. The above for use in a new leaching plant being built at the Washoe Smelter. International Smelting & Refining Company, Tooele, Utah: Two 10 h.p. motors; two 3 h.p. adjustable speed totally enclosed back geared commutating pole d.c. motors with drum controllers; two 5 h.p. motors; one 75 h.p. motor. The above for a sintering plant in an old smelter. International Smelting & Refining Company, Tooele, Utah: One motor generator set, switchboard and regulating devices for Cottrell fume deposition process. Ray Consolidated Copper Company, Hayden, Ariz.: Sixteen 10 h.p. special vertical slow speed motors. The above for driving agitators in an installation using the oil flotation process. Utah Copper Company, Magna, Utah: Seven 10 h.p. special vertical slow speed motors. The above for driving agitators in an installation using oil flotation process. Daly West Mining Company, Park City, Utah: One 300 h.p. 2200 volt hoist motor with liquid controller and complete switchboard equipment. Alaska Gastineau Mining Company, Juneau, Alaska: One 6 ton storage battery locomotive, one 50 kw. motor generator set. Empire Mines & Investment Company, Grass Valley, Cal.: One 500 h.p. motor; one liquid controller for the above; three 200 k.v.a. 4000 volt, O. I. S. C. transformers; one 3-phase induction regulator, 45 kw.; six 35 h.p. special back geared stamp mill motors. The above 500 h.p. motor is for double drum hoist. The control equipment furnished will include all switchboard apparatus and a number of special safety devices. Calumet & Arizona Mining Company, Bisbee, Arizona: Two 300 k.v.a. 3-phase O. I. S. C. transformers and switchboard equipment.

NEW CATALOGUES.

Westinghouse, Church, Kerr & Company of New York have issued No. 6, "Work Done," illustrating many examples of their industrial plant construction.

"Small Motors," No. 20, from the industrial and power department of the Westinghouse Electric & Manufacturing Company, is devoted to the field for the sale of electric ventilating outfits.

The Harris Valveless Engine, Diesel principle, is illustrated and described as to construction, operation and application in a series of pamphlets bound in a handsome folder from the Harris Patents Company, 328 Chestnut street, Philadelphia.

Busch-Sulzer Bros. Diesel Engine Company of St. Louis are distributing an attractive folder from their San Francisco offices in the Rialto Building, entitled "Evidence" and containing a series of users' statements regarding the merits of the Diesel engine.

Mercury Type Direct Current Watthour Meters are attractively portrayed in Bulletin No. 37, a handsome brochure, from the Sangamo Electric Company of Springfield, Ill. Every detail of construction is as well shown as it is possible for clear text, fine pictures and good press work to bring out. This is one of the most beautiful and valuable meter catalogues ever published.

INDUSTRIAL

MATHIAS KLEIN & SONS' NEW PLANT.

In order to meet the constantly increasing demand for their high grade linemen's tools, Mathias Klein & Sons recently moved into their new and larger factory at Avondale on the northwest side of Chicago. The main offices and salesrooms are still at 562 W. Van Buren street, Chicago. the location which this firm has occupied since 1881, when it constituted the entire establishment.

The new factory is built in three sections, the main three-story factory, 55x278 ft., the forge building, 60x233 ft., and the power plant, 60x100 ft. All the buildings are of brick, mill construction and automatic sprinklers giving a low insurance rate.

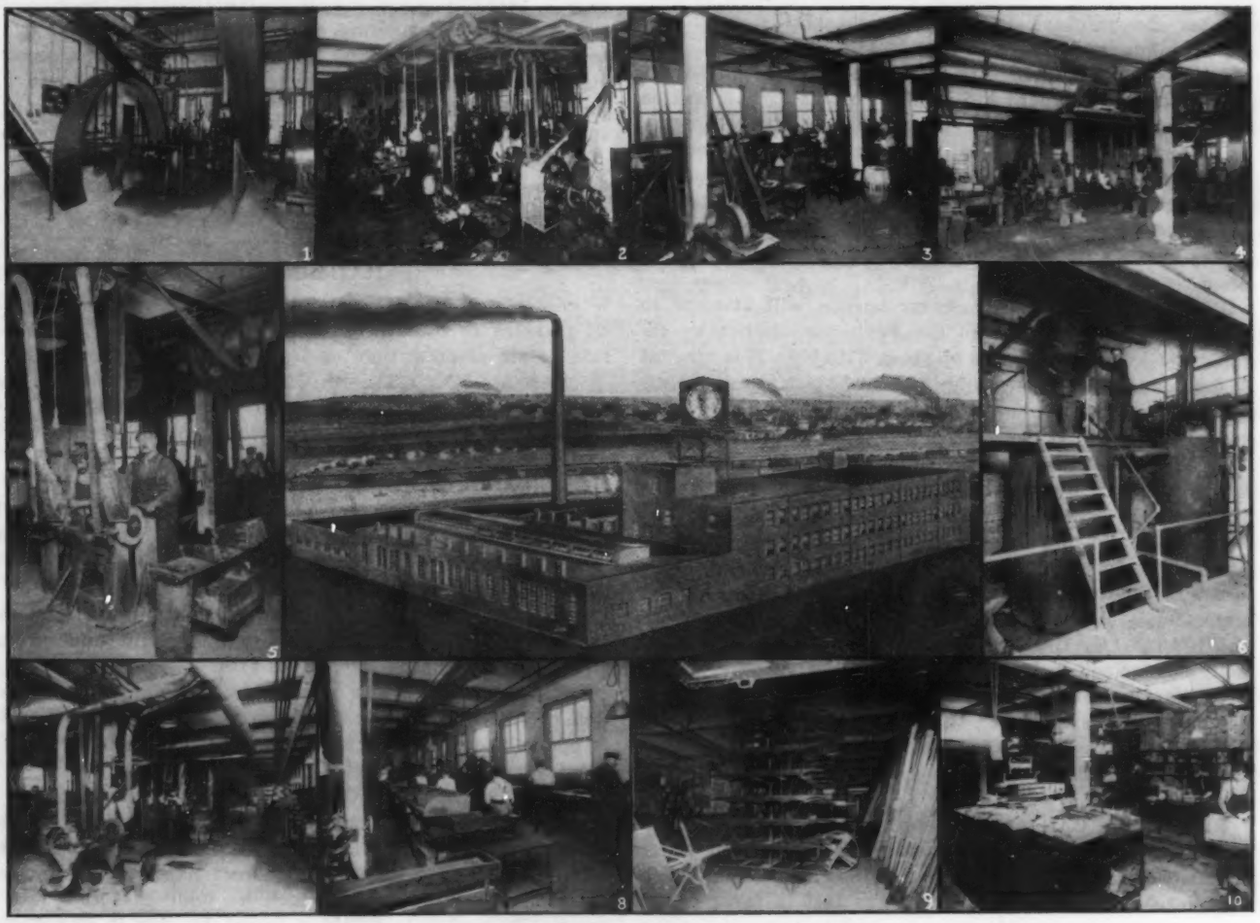
Particular attention has been paid to the comfort and convenience of employees. Good light and good ventilation make for congenial surroundings and efficient work. As the buildings do not yet occupy all the six acre plat which the company owns, it has been parked to provide a noontime recreation and resting place.

The power house is equipped with a 100 kw.Western Electric three-wire generator driven by a 125 h.p. Murray Corliss engine to supply light and power. It also houses the central heating plant and the Flinn-Dreffein gas producer which furnishes 1300 to 1400 cu. ft. of gas hourly for the use of the forging and tempering furnaces. The Corliss engine also operates two lines of shafting in the forge building.

In the process of manufacturing pliers and other tools the blanks are first heated in gas furnaces and then forged into shape with power hammers. The rough tools are then taken by elevator to the milling and drilling department on the second floor, whence they are taken to the assembly department on the third floor where they are sorted and assembled. After being ground to proper sizes by emery wheels, they are heated in gas furnaces for oil-tempering. After careful inspection the tools finally pass to the shipping room on the ground floor when they are placed in standard packages ready for the stock room or outgoing consignment.

In addition to the present production of 3700 pliers a week, this company also manufactures polemen's climbers, wire-reels, pole construction tools, etc.

Mathias Klein founded this business in 1857 and, though now 88 years of age, still takes an active interest, ably seconded by his sons and grandsons. The business has grown and prospered on the policy of always furnishing better tools than specified.



New Plant of Mathias Klein & Sons, at Chicago.

No. 1, Engine Room. No. 2, Milling and Drilling Department. No. 3, Plier Assembling Department. No. 4, Plier Finishing, Tempering and Inspecting Department. No. 5, Grinding Room. No. 6, Gas Producer Plant. No. 7, Climber Finishing Department. No. 8, Plier Converter Assembly Department. No. 9, Constructive Tool Stockroom. No. 10, Packing and Shipping Department.

NEWS NOTES

INCORPORATIONS.

SANTA ANA, CAL.—Pacific Light & Power Company, $40,000,000, subscribed $7000, by W. T. Kerckhoff, H. E. Huntington, K. Kohn, G. S. Patton, C. Forman et al.

NILAND, CAL.—The Niland-Blythe Railroad Association has been formed by Arthur E. Hull, representing the Niland chamber of commerce and G. Ghiglieri, J. S. Diller and P. A. Raab, president of the Los Angeles Creamery Company, representing the Palo Verde district, to build an electric railway between Niland and Blythe.

WATERWORKS.

BOVILL, IDAHO.—At the recent election a bond issue for a new waterworks system to the amount of $12,000 carried.

NEHALEM, ORE.—This city has voted to issue bonds in the sum of $12,500 for the purchase of the present water plant.

SAN DIEGO, CAL.—The City Council has asked Ed Fletcher and James H. Murray, owners of the Cuyamaca lake and water system, to set a price on the whole system, either to purchase or lease.

BILLINGS, MONT.—Dillon, Thompson & Clary of New York have indorsed the legality of the city's $450,000 bond issue for the purchase and improvement of the water system. The bonds will be sold August 15.

LOS ANGELES, CAL.—The City Council has approved the action of the water board in purchasing for $19,000 a portion of the Glendale Consolidated Water Company inside the city. The system is located in North Highland Park and Hermon.

LOS ANGELES, CAL.—By a plurality of 79 over necessary two-thirds vote, voters of Glendale carried the $248,000 water bond. The bonds will be issued to purchase all water systems in the city, which will be combined into a municipal system.

PORTLAND, ORE.—The water bureau will attempt to increase the water service in the Peninsula district by enlarging the system, at a cost of about $113,000. This amount will include the extension of the present 30-inch main, supplying the northeast section of the city, for a distance of nearly 2½ miles.

LOS ANGELES, CAL.—By unanimous vote on application of property owners in the vicinity of Torrence, the Board of Supervisors gave authority for the formation of the Lomita water district, to be used solely in the development of water for domestic uses. L. M. Pollock, J. E. Chandler and M. B. Smith have been appointed directors of the district.

POCATELLO, IDAHO.—The City Council has called a special bond election for August 25, for the purpose of voting on an issue in the amount of $400,000 for acquiring a municipal water system for the city either by purchase of the present water plant from James A. Murray, and bringing it to the requirements of the city, or installing a complete new plant.

RICHMOND, CAL.—At a special election the past week a proposed issue of $2,500,000 in bonds to provide for water for a district composed of Richmond, Stege, Rust, San Pablo and Grant, was defeated. The vote was 1616 in favor of the project and 921 against. It was proposed to bring the water from the Sacramento River at Toland's Landing, 47 miles from Richmond.

OAKLAND, CAL.—F. C. Havens has resigned as president of the People's Water Company and has been succeeded by J. Y. Eccleston. Havens and C. H. Redington retire from the board of directors, and Eccleston, E. A. Heron and John S. Drum become directors. Drum is the president of the Savings Union Bank and Trust Company of San Francisco and was one of the committee which recently reported on the company's finances. The new board of directors consists of Eccleston, Drum, Heron, Arthur G. Tasheira, H. C. Capwell, George N. O'Brien and Frank A. Leach. Havens' letter of resignation explains the reasons for the change. It reads: "In view of the earnest efforts now being made by various committees representing the bondholders, noteholders and others interested in the financial affairs of the People's Water Company, and wishing to avoid even the slightest suspicion of retaining any official position in the directorate of the company that might be supposed to give me any personal or undue advantage over any other person or persons so interested, I desire to and hereby do tender my resignation as a member of the board of directors of the People's Water Company, and also as president of the company, and urgently request that such resignation be accepted forthwith. Voluntarily and unreservedly I desire to take my place among all others financially interested in a readjustment of the financial affairs of the company, claiming over none superior rights or advantages for myself." The voting control of the company has been placed with the Mercantile Trust Company by Havens. This voting control remains operative until January 1, 1915. Another change in the affairs of the company was made at the meeting of the directors, when W. R. Alberger was elected general manager. Alberger was recently vice-president and general manager of the Key Route and Oakland Traction properties. The noteholders' committee and the committee representing the bondholders of the People's Water Company met in joint session recently. Up to date the owners of $787,000 of the notes of the company have signed the agreement that has been proposed.

ILLUMINATION.

EMMETT, IDAHO.—An ordinance has passed the council granting to the Beaver River Power Company, an extension of six months' time on its franchise.

SAN MATEO, CAL.—R. C. Smoot, president of the Merchant's Association, has informed the board that the committee has decided that 58 electroliers will be needed in the proposed city system.

LOS ANGELES, CAL.—The board of county supervisors is now arranging preliminary plans for a lighting project by which all of the boulevards now being made in Orange county will be lighted.

PORTLAND, ORE.—A building permit has been issued to the Portland Gas & Coke Company to erect a steel and concrete gas holder. The structure will be built underground at the head of Clinton street at E 11th.

KENT, WASH.—The council has considered the application of Alfred Giffler of Seattle who offers to have a plant in operation within one year. The matter was left with the lighting committee and the city attorney.

SAN FRANCISCO, CAL.—Master in Chancery H. M. Wright has rendered a supplemental report to the U. S. District Court in the suit instituted by the Pacific Gas & Electric Company to enjoin the city from fixing a 75c gas rate for the year 1913-1914, in which he finds that this rate is practically confiscatory. At a recent hearing it was discovered that a mistake aggregating nearly $95,000 had been made in the figures first submitted. Wright says he found that he should have computed the return on the basis of a net income of $627,577 instead of $722,468. On the basis of the revised net income, Wright says the company was getting only 5.21 per cent on its investment, instead of 6 per cent, to

which, he declared, it is entitled. U. S. District Judge Van Fleet has raised the bond of the gas company from $50,000 to $300,000, following the report that the company now has $260,000 of impounded money on hand, waiting for a decision of its injunction.

TRANSMISSION.

KALAMA, WASH.—The machinery in the new power plant of the Oregon-Washington corporation on the Kalama River was badly wrecked when a large turbine got beyond control. Two of the fly wheels exploded, tearing out one entire side of the building and doing other damage.

SALMON CITY, IDAHO.—Plans are being considered for the installation of a new power plant on the Salmon River. The Gilmore mines will use a great deal of the power to be generated by this new plant which will also furnish power to a large gold dredge to be built and operated on Geertson Creek.

SPOKANE, WASH.—The Public Ownership League has called a meeting to be held at the office of J. M. Simpson this week to discuss the Pacific Telephone & Telegraph franchise. R. B. Martin, secretary of the league, states that the question of a municipal light and power plant will next engage the efforts of the league.

LOS BANOS, CAL.—A survey is being made by the San Joaquin Light & Power Corporation for the running of an additional power line from this city to the Oro Loma country. It will take 30 days to complete the 16 miles of new line. The present line is being taxed to its capacity by the pumping plant motors on the Oro Loma and the new service will be of an increased capacity.

SHOSHONE, IDAHO.—An ordinance providing for incurring an indebtedness in the sum of $18,000 and for the issuance of municipal bonds in that amount for the purpose of purchasing waterworks and franchises of the Great Shoshone & Twin Falls Water Power Company and for extending and enlarging the system has been passed. The bonds will be 20 year bonds, redeemable 10 years from date.

SALT LAKE CITY, UTAH.—Word received here by officials of the Utah Power & Light Company indicates the early completion of the work of rebuilding the transmission pole line running from Park City through the Wasatch Mountains into the Salt Lake Valley via the company's power plants on Mill Creek in Mill Creek canyon, southeast of Salt Lake. The transmission line extends from Park City to Eureka, Utah.

NORTH YAKIMA, WASH.—H. B. Scudder, president of the Yakima Central Heating Company, is reported to have said that the recent public service commission hearing for the purpose of fixing rates of the Pacific Power & Light Company, will be of great value for the purposes of comparison with the cost of producing electrical energy by steam in the district where his company expects to carry on an additional campaign in order to secure a franchise.

QUINCY, CAL.—The supervisors have reconsidered their order to the District Attorney to obtain an injunction against the Great Western Power Company, preventing it flooding the county roads at its dam and reservoir at Nevis. The company does not intend to raise its dam at this time. The county surveyor is instructed to view the new roads built for the county by the company in lieu of the old flooded roads, to see whether the county should accept them.

TUCSON, ARIZ.—Through the issuance of 6 per cent notes the Federal Light and Power Company has secured a loan of $170,000. This sum will be expended on improvements needed by the Tucson Rapid Transit Company and the Tucson Gas, Electric Light & Power Company, subsidiary concerns. The amount has been divided as follows: Power house extensions, $100,000; for street railway improvements, $40,000; gas plant, $10,000; extension of transmission lines for irrigation pumping, $20,000.

OROVILLE, WASH.—Negotiations were completed last week whereby the Similkameen Power Company transfers to the Okanagan Valley Electric Power Company all title and interest in the present electric power site and plant at the Similkemean Falls. It is stated that while the plant itself is of no great value, the power site is one of the best in the state and can be developed at comparatively little expense. The newly organized company is backed by eastern capital. It is further reported that an additional 2000 h.p. will be developed at once.

DENVER, COLO.—The western slope from Durango north to Grand Junction is to be gridironed with hydroelectric power lines for the development of that section of the state as a result of a consolidation of a number of Colorado companies according to information given out by semi-official sources. The Western Colorado Power Company, the Colorado division of the Utah Power & Light Company, has taken over in fee simple the plants of the Ouray Electric Light & Power Company, the Montrose Electric Light & Power Company and the companies operating at Ridgway and Delta. These are to be connected with the plants formerly belonging to the Telluride Power Company, the San Juan Water & Power Company, the Durango Gas & Electric Company, and the Telluride Electric Light Company, all of which are owned by the Western Colorado Power Company.

TRANSPORTATION.

LOS ANGELES, CAL.—The Pacific Electric Railway Company's substation located at Watts was almost completely destroyed by fire, causing a loss of about $15,000.

SEATTLE, WASH.—Councilman O. T. Erickson has introduced an ordinance which specifies and adopts plans for an extension of the municipal car line into Ballard.

SEATTLE, WASH.—The council last week passed an ordinance providing for a new car barn and necessary tracks and switches for the Lake Burien line to be installed at a cost of $3311.

EUGENE, ORE.—That the Portland, Eugene & Eastern Railway Company may begin the electrification of that portion of the west side system south of Whitson about the first of August is the rumor here.

TWIN FALLS, IDAHO.—H. A. Stroud and others are promoting the proposition of building the electric line of the Idaho-Pacific Electric Line, known as the Hagerman line. It is intended to raise $100,000 in this city to start the proposition. E. S. Price, of Tacoma, Wash., is handling the sale of the bond issue.

SAN JOSE, CAL.—F. E. Chapin, vice-president and general manager of the Peninsular Railway Company, has announced that the present electric line out Alum Rock avenue will be converted into a broad gauge road as far as the King Road, by the end of the month, and he adds he is confident that the standard gauge will be continued on from that point to Kirk avenue by the coming January.

SEATTLE, WASH.—The first steps toward the extension of the municipal railway system into the Ballard district were taken last week with the introduction of an ordinance for the creation of this new division, which it is proposed shall start at the northern end of Division A at Third avenue West and Nickerson, and proceed to the proposed canal bridge at Fifteenth avenue, thence northwest to Ballard. The ordinance was referred to the city utilities committee.

TELEPHONE AND TELEGRAPH.

SAN JOSE, CAL.—A private telephone exchange for the use of the fire department was proposed at the meeting of the police and fire commissioners and the chief was authorized to arrange for the installing of the system.

LOS ANGELES, CAL.—The board of public utilities has recommended the granting of an application from the Home Telephone Company of San Pedro for a franchise to construct and maintain a telephone system in Wilmington.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Works of National Carbon Co....
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Benjamin Electric Manufacturing Co.....
Rialto Bldg., San Francisco.

B-3 Blake Signal and Manufacturing Co.....
680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co.....16
(See Pierson, Roeding & Co.)

B-6 Baruch Electric Controller Corporation..... 3
424 Thirteenth St., Oakland, Cal.

B-7 Busch-Sulzer Bros.-Diesel Engine Co.....
Rialto Bldg., San Francisco.

C-1 Century Electric Co.....13
614 South Grand Avenue, Los Angeles; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 Colonial Lamp Works.....
444 Market Street, San Francisco.

C-3 Crocker-Wheeler Co.....
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-5 Crouse, Hinds & Co.....
Chicago, Ill.

C-4 Cutler-Hammer Manufacturing Co.....
579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 D. & W. Fuse Co..... 5
(All Jobbers.)

D-2 Dearborn Drug and Chemical Works.....11
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco.

E-2 Edison Storage Battery Supply Co.....12
441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co.....
247 Minna Street, San Francisco; Gentral Building, Los Angeles.

E-4 Electric Storage Battery Co..... 5
Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; 118 New Montgomery Street, San Francisco; Colman Bldg., Seattle.

F-1 Fairbanks, Morse & Co.....11
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co.....
Rialto Bldg., San Francisco; Colman Bldg., Seattle.

G-1 General Electric Co..... 14
124 W. Fourth Street, Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

H-1 Habirshaw Wire Co.....
(See Western Electric Company.)

H-2 Hemingray Glass Co.....12
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-3 Hoaglund-Hulse Electric Co.....
1707 Naud Street, Los Angeles.

H-4 Holophane Works .....
Aronson Bldg., San Francisco.

H-5 Hunt, Mirk & Co.....
141 Second Street, San Francisco.

H-5 Hubbard & Co.....
Rialto Bldg., San Francisco.

I-1 Indiana Rubber and Insulated Wire Co.....13
807 Mission Street, San Francisco.

K-1 Kellogg Switchboard and Supply Co.....
Aronson Bldg., San Francisco.

K-2 Keystone Boiler Works .....
201 Folsom Street, San Francisco.

K-3 Klein & Sons, Mathias 12
579 Howard Street, San Francisco.

K-4 K-P-F Electric Co..... 3
37 Stevenson Street, San Francisco.

L-1 Leahy Manufacturing Co.....
Eighth and Alameda Streets, Los Angeles.

L-2 Locke Insulator Manufacturing Co.....16
(See Pierson, Roeding & Co.)

M-1 Mannesmannrohren-Werke .....
Rialto Bldg., San Francisco.

M-2 McGlauflin Manufacturing Co.....
Sunnyvale, Cal.

M-4 Morse Chain Co.....
Monadnock Bldg., San Francisco.

M-3 Moore & Co., Charles C.....
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; 40 First Street, San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 Nason & Co., R. N.....
151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeels; Rialto Bldg., San Francisco.

N-3 National Lamp Works of G. E. Co.....
(All Jobbers.)

N-4 New York Insulated Wire Co.....
629 Howard Street, San Francisco.

O-1 Okonite Co. (The) 16
(All Jobbers.)

P-2 Pacific States Electric Co..... 2
236-240 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Avenue, So., Seattle.

P-4 Pelton Water Wheel Co.....12
2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co..... 5-16
Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-7 Pittsburgh Piping & Equipment Co.....16
Monadnock Bldg., San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The.....12
211 J Street, Sacramento; 356 Market Street, San Francisco.

S-2 Simonds Machinery Co.....
117-19-21 New Montgomery Street, San Francisco.

S-3 Simplex Electric Heating Co.....16
612 Howard Street, San Francisco.

S-4 Southern Pacific Co.....11
Flood Bldg., San Francisco.

S-5 Sprague Electric Works of G. E. Co.....13
Rialto Bldg., San Francisco; Colman Bldg., Seattle.

S-6 Standard Underground Cable Co..... 5
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.

T-1 Thomas & Co., R.....
(See Western Electric Co.)

V-1 Van Emon Elevator Co.....
56 Natoma Street, San Francisco.

W-1 Wagner Electric Manufacturing Co..... 5
Rialto Bldg., San Francisco.

W-2 Western Electric Co..... 4
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 907 First Avenue, So., Seattle.

W-4 Westinghouse Electric and Manufacturing Co.....
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Bldg., Seattle; Paulsen Bldg., Spokane.

W-5 Westinghouse Machine Co..... 6
141 Second Street, San Francisco.

W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric and Manufacturing Co.)

W-7 Weston Electrical Instrument Co..... 3
682 Mission Street, San Francisco.

W-8 Western Pipe & Steel Co.....
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.